THE

# ELECTRICAL REVIEW.

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## ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: July 30, 1915. [No. 1,966.

| | Page |
|---|---|
| Russia and Foreign Capital | 129 |
| Lead | 130 |
| Wireless Telegraphy and the War | 130 |
| E.A.C. Drum Type Control Gear for A.C. Motors (*illus.*) | 131 |
| The Practical Result of Point Five Tariff | 132 |
| Heavy Tonnage Electric Service on the Norfolk and Western Railway, U.S.A. (*illus.*) | 134 |
| Correspondence— | |
| Electric Signalling in Mines | 136 |
| "Autres Temps, Autres Moeurs" | 136 |
| Shop Window Lighting | 137 |
| Branch Offices | 137 |
| Legal | 137 |
| New Electrical Devices, Fittings and Plant (*illus.*) | 139 |
| War Items | 139 |
| Business Notes | 139 |
| Notes | 144 |
| City Notes | 148 |
| Stocks and Shares | 151 |
| Share List of Electrical Companies | 152 |
| Reviews | 153 |
| The Central Power Station of the Randfontein Estates, by R. Turnbull Mawdesley (*illus.*) (*concluded*) | 154 |
| A Simple Radiographic Method for Localising Bullets, by L. Crouch (*illus.*) | 155 |
| On an Unbroken Alternating Current for Cable Telegraphy, by Lieut-Colonel G. O. Squier (*illus.*) | 156 |
| Calorising: A Protective Treatment for Metal, by H. B. C. Allison and L. A. Hawkins (*illus.*) | 158 |
| Indian Notes | 159 |
| Foreign and Colonial Tariffs on Electrical Goods | 159 |
| New Patents Applied for, 1915 | 160 |
| Abstracts of Published Specifications | 160 |
| Contractors' Column | Advertisement page xviii |

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## RUSSIA AND FOREIGN CAPITAL.

IT is undoubtedly a fact that Russian industries and public services, in the form of railways, tramways and electric lighting works, would not have reached their present stage of development had it not been for the enormous investments of foreign capital, which first began as far back as the forties of the past century. The country is considered to be, perhaps even more so than the United States, a land of unlimited possibilities owing to the possession of great natural resources, although the international impoverishment due to the war renders it probable, in the opinion of a German author, that on the conclusion of peace Russia will have to depend to a greater extent upon herself for future progress, as the financial strength of the other nations now at war will only suffice for themselves when that period arrives. If this assumption should eventually prove to be correct—and it certainly possesses an element of probability—it will follow as a matter of course that the present movement for the nationalisation of industries in Russia will not assume the proportions which are hoped for, if not expected, and that that country will still have to rely upon other nations for a large quantity of machinery and plant in the future, in exchange for agricultural and other natural products. In the meantime, let us see what foreign capital has accomplished for Russia in the past.

The foundation of modern industries in Russia is to be found in the iron and steel trades, the engineering trade, the coal industry, the petroleum industry, and the textile trades, all of which are the work of West European enterprise. Belgian and French capital has taken a prominent part in the coal and iron and steel industries, and German investments have been made in the textile industry of Russian Poland, whilst the petroleum district of the Caucasus has been opened up by Swedish and British capital. The real centre of the coal mining and iron and steel industries is in the Donetz basin, whence the bulk of the output of iron and steel is derived. Indeed, if foreigners had not come forward with capital and enterprise, notably John Hughes, it is thought that the iron and steel trade there would probably to-day have remained in an undeveloped state. It is calculated too, that one half of the total production of coal in the region of the Donetz, and in the Dombrovo basin in Poland, which has been for some months past in enemy occupation, is raised by foreign undertakings. In the case of the petroleum industry the expansion has likewise been effected without the assistance of the Government, the progress made being attributed to the arrival of Robert Nobel, a Swede, in Baku in the year 1874, and the formation by the Paris firm of Rothschild, of the Caspian-Black Sea Commercial and Industry Co.

Apart from the great indebtedness of Russia to other countries by reason of the flotation of various foreign loans, the greater portion of the capital invested in the railway



C

system has been raised abroad. At one time the Germans realised considerable profits from railway construction, but that was in the early days of railway work. During the past few years English capital has participated specially in Russian joint-stock companies, particularly in regard to oil undertakings, whilst the North Americans, who formerly ignored the development of Russia, have entered into competition to secure concessions for naval work, tramways and electric lighting works. The Germans, however, claim to be the oldest in the field among the joint-stock companies, and in regard to the manufacture of iron and steel goods, the working of gas and electric lighting stations, the construction of electrical machinery, and the production of chemicals. The chief creditor of Russia is France and the second is Germany, which, it is estimated, has financial interests, including Russian Government securities, amounting to a minimum of £200,000,000 in the country. In recent years, however, the Teutonic participation has been more in the direction of investment in Government financial transactions than in industrial undertakings of any kind.

The future of Russia naturally depends to a great extent upon the successful conclusion of the war, when it is hoped to secure emancipation from German industry as far as possible. On the one hand, a new railway is projected from Petrograd and another city to the north of Russia, where the sea coast is free from ice all the year round, while on the other, a free passage through the Dardanelles is expected in the near future. In this way Russia should be able to find new or more extended markets for her products, and not be dependent, as was the case in 1912, upon Germany for the absorption of exports of the value of £75,000,000 out of total exports of £160,000,000. The exports from Germany to Russia, however, are stated to have amounted only to 7½ per cent. of the total exports of the value of £125,000,000 in the same year, a percentage which represents £9,375,000, and which seems an incredibly small sum. At any rate, it may be definitely concluded that the prospects of the further cultivation of British trade with Russia will be greatly improved on the conclusion of the war. Just as Russia is independent of Germany under existing circumstances, so, when the war is over, will the former endeavour to remain free from the latter as much as possible. That Teutonic competition will be resumed there can be no question, but it is doubtful whether the measure of financial support which it has received in the past will be also available in the future, owing to the financial exhaustion caused by the war. It is this breach that British firms, together with their Allies, should seek to fill, and provided that prices and general conditions are equal, their efforts should be crowned with success. The Anglo-Russian Chambers of Commerce in London and Petrograd, and the Anglo-Russian banking interests, should be able to render material assistance to British manufacturers in this direction, as the development of the British export trade would probably be a matter of some difficulty without substantial aid from these institutions.

**Lead.**

The lead market has had a number of ups and downs during the last few weeks, and still shows a tendency towards considerable uncertainty and irregularity. The period of active manipulative buying seems to have given place, however, to a more subdued atmosphere, and considering the weakness which has been seen in other directions, prices have not yielded nearly as much as might have been expected. There has been som speculative selling, impelled to a certain degree by the manifold difficulties put in the way of the export trade, while activities on account of home consumers have been of a decidedly restrained character. It is most unlikely, however, that any insuperable obstacles will be placed in the way of merchants wishing to ship lead to our Allies in Russia or France, so that the actual interference with business may be more fanciful than real. The demand for Russia continues, but it is not possible to trace a great deal of business as having been done for shipment from English ports, the majority of the orders being placed in Spain, while inquiries put forward in America have been rather barren of result because holders there are asking too much money.

Whether American lead producers will be induced to moderate their terms remains to be seen, but certainly the United States metal markets generally seem to be suffering from a touch of what may be "the morning after." The reckless speculation in copper and spelter has left a lot of stale "bulls" across the Atlantic, and realisations sooner or later will have to become general. Consumers are certainly not disposed to play into the hands of the gang of German-American stockbrokers and others who have been engaged in rushing up metal prices, and it is to be hoped that some strong line will be taken by the British authorities in connection with the battering down of all German influences in the Colonial sources of supply, such as Australia. The definite and firm stand taken by the Commonwealth authorities puts the Mother-Country hopelessly to shame in this respect, for our policy, so far, is merely one of shuffling and temporising. It is important to note that the Broken Hill lead interests are firmly banded together now, and will brook no German interference. The extension of the smelting works at Port Pirie is being pressed on with urgency, and about 3,700 tons of concentrates a week are now being produced, while further extensions are in hand, and it is hoped within the next few months to enable the lead smelters to treat 4,500 to 5,000 tons of concentrates a week.

The American production has increased enormously during the last year or so, and output has not yet reached the greatest possible point. Under no circumstances at present obtaining, or at present in sight, can there be any shortage of lead in the United States, because not only is there an abundance of lead ore, but there is, also, a large surplus lead smelting capacity available, and if production is not stimulated by the prices now ruling, it is impossible to conceive what combination of circumstances can bring about enlarged output. It is interesting to note that prices of lead have begun to move up rather sharply in Germany, the natural inference being that that country is beginning to feel the pinch of the British blockade.

**Wireless Telegraphy and the War.**

The furious controversy which raged around the question of the Imperial wireless chain in 1912-13 is still fresh in the minds of our readers; it involved vast interests, both political and commercial, of which the inner workings were known only to a few. It is therefore exceedingly interesting to obtain a glimpse behind the scenes, such as was afforded by Mr. Godfrey Isaacs in his speech at the annual meeting of the Marconi Co. on Monday last, which will be found fully reported elsewhere in this issue.

Thanks to party political considerations, the construction of our wireless chain was delayed at least a year, in spite of the extreme urgency attached to its provision by the Government. Writing on this subject in our issue of August 1st, 1913, we urged that the authorities who were responsible for the defence of the Empire had a right to be trusted, and pointed out that "no man can tell what to-morrow may bring forth." Truly we did not then anticipate that in 12 months, almost to the day, we should be at war with Germany.

Happily for us, our Navy was able to block up the German fleet in its own waters, and though two of our cable stations were wrecked by raiding cruisers, our communications with the Empire never for a moment suffered interruption, and the want of the Imperial wireless chain was not greatly felt; but if other conditions had prevailed —had we been opposed by a different combination, and had our enemies secured even temporary control of the sea— how bitterly we should have regretted the delay which deprived us of the wireless service!

They do things differently in Germany. How their wireless chain, erected regardless of cost in the minimum of time and without discussion, enabled our enemies to warn their ships that war had broken out, and they must run for safety, is tersely told in the speech to which we have referred. An interesting corollary to the story will be found in our "Notes."

## E.A.C. DRUM TYPE CONTROL GEAR FOR A.C. MOTORS.

UP to the present but little effort has been made by manufacturers of motor control apparatus to adopt a similarity of design for starting gear for squirrel-cage and slip-ring motors. The former are usually of the double-throw knife switch pattern, while the latter have usually been of the face-plate type similar to D.C. starting switches. The causes for this are probably that the squirrel-cage motor was first introduced and used in America, and for some years was objected to by English supply authorities owing to the large current taken during starting. Consequently, the slip-ring motor was used here with starting gear on the lines of D.C. starting switches. When the squirrel-cage motor was finally taken up in this country, a similar type of starting gear was used to that which had been adopted in the United States.

This use of two different types of starting gear possesses many disadvantages, as it is seldom that squirrel-cage or slip-ring motors can be used exclusively in any large industrial system. In such cases it frequently occurs that the actual starting and stopping of the machine is in the hands of inexperienced operators, and only a small electrical staff is employed for actual maintenance purposes. The fact that two entirely different types of starting gear are used is likely to confuse these operators, and, in addition, means the duplication of spare parts.

The Electrical Apparatus Co., having these points in view, decided to adopt a standard system of motor control gear which could be used for any type of A.C. polyphase induction motor. The drum type of switch was adopted; it has been proved the most suitable for heavy industrial services.

FIG. 1.—OIL-IMMERSED STARTER WITH NO-VOLT AND OVERLOAD RELEASES.

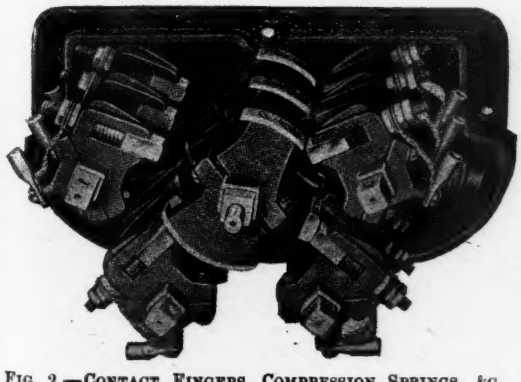


FIG. 2.—CONTACT FINGERS, COMPRESSION SPRINGS, &C., DRUM-TYPE STARTER.

The starters and controllers for both slip-ring and squirrel-cage motors are similar in appearance and the operation of starting is performed in the same manner; the switch contacts are interchangeable for a given capacity of switch, thus reducing spare parts. Further advantages are that with squirrel-cage motors, the motors cannot be left running connected in "star" if star-delta starters are used, or with the auto-transformers in circuit if auto-transformer (compensator) starters are used. The method of starting up is always by a straight forward movement of the handle, and the patent E.A.C. slow motion device epsures a compulsory pause in the starting position. The starters can be supplied either non-automatic or with fuses, or they can be fitted with no-voltage and overload release.

The whole construction consists of clamping the current-carrying parts on to mica-insulated steel bars—thus limiting insulation breakages and giving an absolutely fireproof construction.

The gear is made in two types, viz.: Air-break totally-enclosed starters and oil-immersed totally-enclosed starters.

*Air-break Starters.*—The range of totally-enclosed gear covers a small air-break switch arranged either to give star-delta or series-parallel starting connections, or suitable for switching small squirrel-cage motors direct on to the line. There is also a range of totally-enclosed air-break auto-transformer (compensator) starters for motors up to 100 H.P. on 650 volts. It will be noted that this provides for any moderately sized squirrel-cage motor, and is particularly suitable for textile mills, several electrically-driven spinning sheds having been equipped.

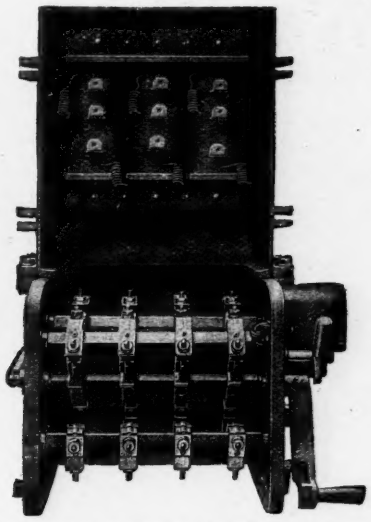


FIG. 3.—INTERIOR, AIR-BREAK AUTO-TRANSFORMER STARTER.

Fig. 3 shows the general arrangement of the air-break type auto-transformer starters, illustrating the accessibility of both transformer and switch for changing the transformer tappings or cleaning and general inspection purposes. As mentioned above, the starters can, if necessary, be fitted with no-volt and overload automatic release trips with fuses, ammeters, voltmeters, etc., a control unit being supplied consisting of an auto-transformer starter with no-volt and overload release or fuses, the starting switch being in the centre box, the transformer in the lower box and the overload release in the upper box; an ammeter can be fitted to the top of the control unit, which can be attached to a wall or mounted on a pedestal. The starters can be supplied with plain bushed cable holes, with holes screwed for conduit, or with cable sealing boxes where multicore cable is to be used.

FIG. 4.—THE E.A.C. SWITCH FINGER.

*Oil-immersed Gear.*—In this class the range covered is very much greater. It includes star-delta starters, series-parallel starters, or non-automatic oil switches up to 125 amps. capacity of 650 volts, or auto-transformer starters up to 200 H.P. on 3,500 volts; also all types of starters for slip-ring motors up to 400 H.P. capacity. It is thus possible for a control equipment to be supplied for practically every duty and any type of induction motor, especially if used in combi-

nation with E.A.C. high-tension automatic oil switches. The range covered will be best appreciated from the following table :—

| Squirrel-cage Motors. | Slip-ring Motors. |
|---|---|
| Direct-starting switches. | Rotor starters. |
| Series-parallel starting switches. | Combined rotor and stator starters. |
| Star delta starting switches. | Non-reversing controllers. |
| Auto-transformer starters. | Reversing controllers. |

Slip-ring motor starters have usually to withstand heavier duties than the starting gear for squirrel-cage motors, and it is the opinion of the designers that it is preferable to have all

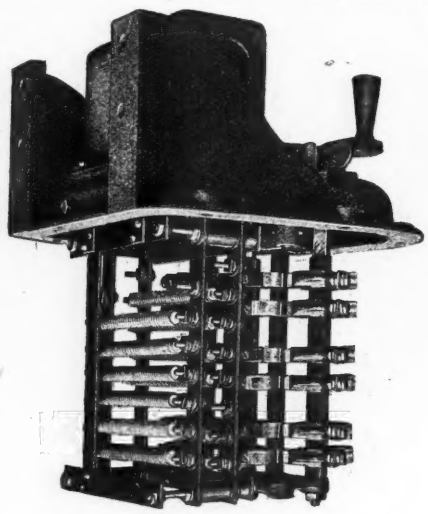


Fig. 5.—Interior, Oil-immersed Starter or Controller with Self-contained Resistance.

starters with slip-ring motors oil immersed, as such switches have a larger starting capacity, and the wear and tear on the starter contacts is less if these are immersed in oil.

The similarity in appearance of various types of oil-immersed switches will be well appreciated from the fact that fig. 1 practically represents a non-automatic oil switch, a star-delta starter, auto-transformer starter, or any type of E.A.C. starter for a slip-ring motor. The similarity of the internal construction is illustrated by fig. 6, a transformer starter with the cover removed, and fig. 5, which shows a rotor starter with cover removed. Star-delta starters or non-automatic oil switches are also similar, but there is no resistance or transformer.

From the above remarks it may be thought that to obtain the

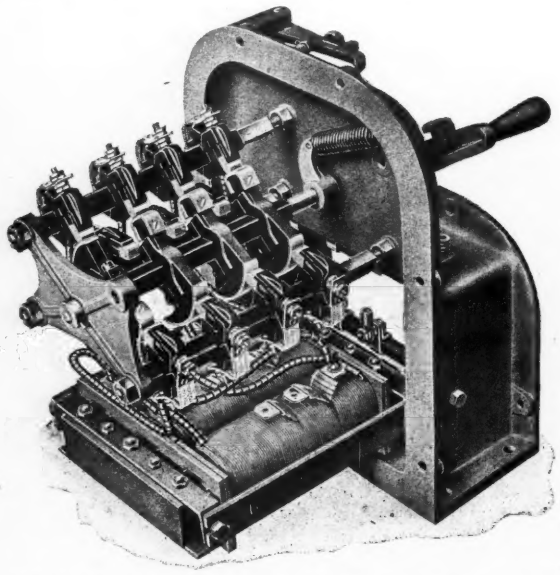


Fig. 6.—Interior, Wired-up Oil-immersed Auto-starter.

full advantage of the E.A.C. system, it is necessary to instal oil-immersed gear throughout. This, however, is not the case, as the contacts and detailed parts are interchangeable for a given capacity of switch between totally-enclosed air-break switches and oil-immersed switches, and the oil-immersed switches can be fitted with similar automatic features, fuses or instruments to the air-break switches and cable outlets can be arranged in the same manner.

A further advantage is that the old arrangement of mounting the various details of control gear on an angle iron panel is entirely dispensed with, and all the control gear forms a complete self-contained ironclad unit.

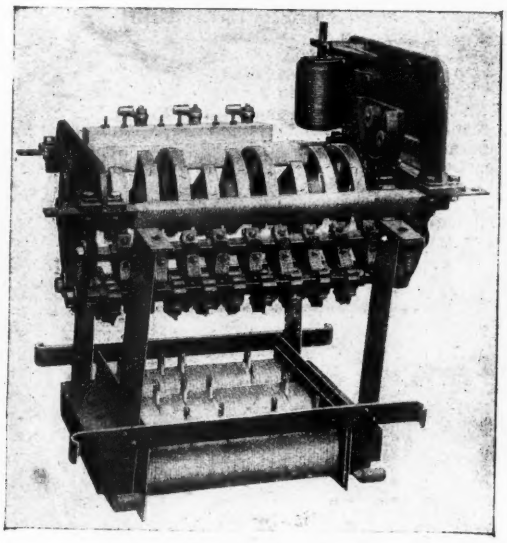


Fig. 7.—Interior, Floor-pattern Oil-immersed Auto-starter, for up to 400 h.p.

It should not be supposed that control equipments for slip-ring motors are very expensive as, in spite of the fact that the slip-ring motor starters are always oil immersed, an efficient motor control equipment for these motors can be supplied at a price competitive with the obsolete face-plate type gear. For large machines and high-tension machines the starters can be combined with the E.A.C. drum type oil switches.

## THE PRACTICAL RESULT OF THE POINT FIVE TARIFF.

At the recent meeting of the Incorporated Municipal Electrical Association*, very little time was available for replies to the discussion on this subject. Mr. T. Roles (Chief Electrical Engineer, Bradford) has since communicated a detailed reply, of which the following is an abstract :—

Like Mr. Long, he was disappointed in the turn taken by the discussion. The majority of the speakers seemed to be under the impression that the Rateable Value tariff and the Point Five tariff were synonymous, whereas a number of Point Five tariffs were in no way based on the rateable value system of charging. As had been pointed out by the authors, it was somewhat unfortunate that the Point Five Association asked two persons, both of whom had adopted the rateable value system in connection with their Point Five tariffs, to undertake the preparation of the report; this being chiefly a statement of the results of the working of the Point Five tariffs in Bradford and Sunderland, it followed that the rateable value system must to a certain extent be dealt with.

The Point Five Association as a body held the opinion that no great headway could be made in the supply of electricity for heating, cooking, and other domestic purposes apart from lighting, at any price exceeding ½d. per unit, in districts in which gas was sold at 2s. 6d. or under per thousand cubic feet. In Bradford and Sunderland the fixed charge arrived at on a rateable-value basis had been so calculated that, plus a charge of ½d. per unit for current used for lighting purposes as registered by meter, it was on the average equal to the cost of lighting a house moderately well throughout at between 3½d. and 4d. per unit. It followed, therefore, that on the average all units sold for heating and cooking purposes, and any increase of illumination above the ordinary, were obtained by the consumer at a flat rate of ½d., and it was to the results of selling current for these purposes at a flat rate of ½d. that the attention of the members of the Association was primarily intended to be drawn, whereas by most of the speakers these results had only been given a secondary place, if mentioned at all, and the pros and cons of the rateable-value system had provided the main theme

* Electrical Review, June 18th and 25th.

of the discussion. Several speakers revived a jibe which had on a number of occasions been made at the expense of the Point Fives, to the effect that a member of this Association was one who, while contending that he sold electricity at ½d. per unit, in reality sold it at an average price of between 1½d. and 2d. The makers of such statements were simply raising a bogey for the purpose of knocking it down, as, as far as he was aware, no member of the Point Five Association had claimed to supply electricity for *all* domestic purposes at a flat rate of ½d. per unit or less. The majority of the members, however, did claim to be selling electricity for heating and cooking purposes at ½d. per unit, whether their tariff was based on the rateable-value system or on a flat rate for lighting and a separate flat rate for heating and cooking. If the average rate paid by all domestic consumers for the whole of the electricity consumed by them for lighting and other domestic purposes were calculated out, it must naturally be considerably higher than ½d. per unit, owing to the higher prices which were charged for the lighting units. It would be equally as sensible to maintain that an engineer who charged a consumer a flat rate of 1d. per unit for energy supplied for power purposes did not supply electricity at 1d. per unit, owing to the fact that as the same consumer took a large lighting supply at 4d. per unit, the average charge made for lighting and power purposes combined might exceed 2d. per unit.

In opening the discussion, Mr. Wilkinson called attention to the table on page 11 of the report, and deduced from the same that although a Point Five tariff caused a very healthy increase in the number of units sold, the effect upon the revenue of the undertaking was anything but healthy. As several other speakers emphasised this point, the authors thought it well to clear up a misunderstanding which had arisen in respect of these figures. In putting forward this table and a similar table applying to the Sunderland undertaking, the authors wished to show the effect of a Point Five tariff on consumers who had previously been supplied under the tariffs existing prior to the adoption of the new method of charging. The report stated that, "Owing to changes of tenancy and alterations in other conditions, the comparison given below relates to only 138 of the consumers changed over, the periods covered being the year prior to the introduction of the Point Five tariff and the year ended December 31st, 1914." As the consumptions of these consumers increased by 94.9 per cent. under the new tariff, it was very clear that the tariff encouraged consumers to increase their consumption of electricity, and it had been ascertained that the additional units were mostly consumed by reason of the use of heating apparatus. With regard to the falling-off in the revenue derived from the 138 customers, this was only what might be, and in fact was, expected. As pointed out by Mr. Wilkinson, only the consumers who would benefit by the introduction of an alternative new rate would take advantage of it. It was hardly likely that the 138 consumers in question, having the option of remaining on the flat rate of 4d. or of changing over to the domestic rate of 15 per cent. on the rateable value and ½d. per unit, would have changed over to the latter unless they saw some definite advantage would be gained by so doing. In some cases the only advantage was that they could obtain current for heating purposes at a low rate, but in the majority of cases a direct reduction was effected in the cost of their lighting supply. The table, however, made it very apparent that, in the case of Bradford, at any rate, there was no foundation for the suggestion that a Point Five tariff under the rateable-value system was a means of deluding the undertaking's consumers into believing that they were getting a substantial reduction and current for heating and cooking purposes at a low rate, whereas in reality they were not.

It should also be pointed out that when the domestic tariff was instituted at Bradford, it was fully realised by the Electricity Committee that the time had arrived for a reduction to be made in the charges to domestic consumers who had wired their houses throughout or practically so, and consideration was given to the lines upon which such reduction should be made. Such consumers were, as previously stated, at the time being charged on a flat rate of 4d. per unit, and it was obvious that if a flat rate was retained and a reduction made to 3½d. or 3d. per unit, all consumers would benefit irrespective of the amount of current consumed or the load factor. By adopting the rateable value system, the good consumers were put in a position to obtain the necessary reduction, and little or no reduction was allowed to consumers with poor load factors. Encouragement was given to the latter to increase the size and use of their installations, and to all domestic consumers to utilise electricity for heating and cooking purposes. Had the committee adopted the same course as had been pursued in a number of towns, and reduced the price to 3d. per unit, the revenue received from the 138 consumers mentioned in the first table on page 11 would have been reduced from £1,566 to £1,174. As shown by the table the revenue actually obtained was £1,358. The result, therefore, as regards the 138 customers was almost identical with what it would have been had the flat rate for lighting purposes been reduced from 4d. to 3d. per unit and these consumers used exactly the same amount of current for lighting purposes, and 94.9 per cent. increase in their consumptions—equal to 88,992 units—had been sold them for heating and cooking purposes at ½d. per unit. These consumers, however, were naturally better off under the Rateable Value tariff, as a certain proportion of the increased consumption had been used for lighting purposes, for which under the above-mentioned double flat rate system they would have been charged 3d. per unit. The revenue of the undertaking has, in addition, not suffered to the extent it would have done under flat rates of 3d. for lighting and ½d. for heating and cooking purposes, as the consumers whose residences are only partially wired and/or the load factors of whose installations are low have not received an undeserved reduction of 25 per cent. on their accounts.

The table at the bottom of page 11, which was either overlooked or ignored by the various speakers who were alarmed at the results set forth in the table at the top of the page, gives a much better indication of the results of the working of the Point Five tariff. In this case the comparison applies to all domestic consumers connected for the complete twelve months ended December 31st, 1914, and shows that the average number of units consumed per house in the case of consumers on the flat rate was 367 and the average revenue £5 18s., as against an average number of units per house of 1,082 and an average revenue of £7 12s. 4d. in the case of the consumers on the Point Five tariff. There is little doubt that consumers on the flat rate are using electricity for lighting purposes only, and, therefore, those on the Point Five tariff are consuming on the average 715 additional units per house either for increased lighting or for heating and cooking purposes. The average revenue obtained for the additional 715 units is £1 14s. 4d., so that the average price per unit obtained for the additional current sold is .575d. Taking into consideration the very small additional capital outlay involved, and the fact that the total running costs and expenses due to management are but slightly increased, in the writer's opinion the result is very satisfactory.

As to large supplies of electricity being immediately demanded by upper-class residential houses for heating and cooking purposes in the event of a Point Five tariff being adopted, with consequent overloading of the mains, well over 50 per cent. of such consumers reside in premises having rateable values of £30 or less, which are naturally those of middle-class consumers.

The writer agrees that the supply of electricity for heating and cooking purposes presents a difficult problem in a small residential town. It must, however, be recognised that if a satisfactory half-watt lamp of moderate candle-power makes its appearance, as is likely to be the case, the revenue received by all undertakings for current supplied for lighting purposes will be considerably reduced, and the undertakings in residential districts will be far more badly hit than those relying chiefly upon power supplies for their incomes. The only way in which such districts can make up this loss in revenue appears to be in the direction of increasing their outputs for other domestic purposes. The problem has, therefore, to be tackled sooner or later, and in the opinion of the writer it is better to face it now and obtain some very necessary experience, rather than to wait until the reduction in the lighting output is an accomplished fact. A tariff of 1d. or ¾d. per unit for heating and cooking purposes, in accordance with the price charged for gas in the district, might be adopted, and the results of such a tariff would no doubt form a valuable basis on which to decide whether still further reductions could usefully be made. As far as his experience goes, however, even were a Point Five tariff to be instituted at once, no such rush of applications for supplies for heating and cooking purposes would be experienced as many persons seem to anticipate.

The statement made that St. Marylebone was the only Point Five undertaking which had not adopted the rateable-value system, but had the kilowatt maximum-demand system in operation, was totally incorrect. Both Poplar and West Ham were also working on the kilowatt-demand system, and Southampton, Luton, and Wakefield had adopted a flat rate of ½d. per unit for heating and cooking purposes.

The statement that the rateable-value system lent itself to the production of a tariff which landed the undertaking in a loss was certainly not borne out by the experience gained in Bradford, and must astonish those in control of the very large number of undertakings in the country which charged on this system and yearly showed most excellent results. Mr. Wordingham also appeared to be under the delusion that the rateable value system and the Point Five tariff were one and the same thing.

He (Mr. Roles) was in total disagreement with this speaker's dictum that the figures given in the paper clearly showed that a system could not be right which nearly doubled the consumption and yet reduced the revenue. Taking all residential consumers into account, the undertaking had very considerably increased its revenue, and the revenue per house received from consumers on the Point Five rate was nearly 30 per cent. more than that received from the flat-rate consumers. Any substantial reduction in a tariff was almost certain largely to decrease the revenue derived from and to increase the consumption of existing consumers, but the loss in income in respect of such consumers was usually more than made good by additional revenue obtained from new consumers gained. The speaker also stated that he did not believe it was possible to heat water by electricity economically in sufficient quantities for ordinary domestic supply, and that it was a great mistake to try to do it or to say that it could be done. Whatever he might believe, it was a fact that a number of electric water heating installa-

tions were at present in use, were giving satisfaction, and were proving economical. Even if this were not the case, the writer was at a loss to know why it was a great mistake to try to do it. Had the pioneers of the electrical industry been imbued with similar ideas, instead of faith in the future of electricity and courage to tackle the apparently impossible, electricity supply undertakings would probably be non-existent to-day.

With regard to the opinion expressed that it was wrong to increase the capacity of radiators in order to heat the air of the room in which they were installed, and that it was essential to keep the air cool, and warm the individual, this, though it might be scientifically correct, was not the opinion of the great body of consumers who had to be catered for. Whatever form of heating was adopted, the usual practice was to warm the air of the room until it reached a temperature of about 60° F., and one would find it very difficult to persuade a person that he should sit in a room having a temperature somewhere near freezing point—as was the case on many winter days—and toast a portion of his anatomy by the rays of a one-kilowatt radiator, leaving the other portions to freeze, it being usually difficult, if not impossible, to arrange for such a person to be surrounded by radiators.

Mr. Lackie's example of what the bill of a domestic consumer living in a £40 house in Glasgow would probably be, indicated that while the lighting consumers at Glasgow were supplied at an exceedingly cheap rate, the heating and cooking tariff was not sufficiently low to induce consumers to use such apparatus to any great extent. It was shown that in such a house the number of units used for heating and cooking purpose would only be 400. On a very moderate basis, one might except a consumption of over 2,000 units for cooking purposes alone, leaving heating entirely out of the question.

Mr. Nichols Moore maintained that progress in the supply of current for heating and cooking purposes could be made with a tariff of 1d. per unit. The writer did not think that any member of the Point Five Association would disagree with him, as practically all had had experience with a 1d. or ½d. rate prior to adopting a Point Five tariff. To compete seriously with other methods of heating and cooking, however, they were of the opinion that the tariff must be reduced to ½d.

Mr. Long asked how a Point Five tariff could be justified in the case of towns in which the cost of coal per unit was in the neighbourhood of ½d. When fixing the amount to be allocated to standing and running costs under any tariff, it was usual for at least 25 per cent. of the coal costs, and considerably higher percentages of other items making up the works costs, to be debited to standing costs (see Report of Joint Committee of M.T.A. and I.M.E.A. on "Charges for Electrical Energy supplied for Traction Purposes from Combined Stations.") It must also be remembered that the coal costs quoted were average costs, and that the cost of generating units during the hours of light load was very much higher than during the heavy load periods. In works supplying residential districts the number of hours of light load was very high compared with the number of hours during which a moderately good load was sustained. The supply during the hours of light load was usually provided by small inefficient generating sets or by large generating sets run at an uneconomical load. If, therefore, by selling electricity at a cheap rate for heating and cooking purposes, a good day load could be obtained, not only was the cost of generation reduced during the hours of light load, but the average figures per unit in respect of each item of works costs might also be appreciably lowered.

## HEAVY TONNAGE ELECTRIC SERVICE ON THE NORFOLK AND WESTERN RAILWAY, U.S.A.

A recent issue of the *Railway Review*, of Chicago, contains an interesting description of some electric locomotives which have been introduced by the Norfolk and Western Railway (U.S.A.) to deal with heavy coal traffic on its main line between Bluefield and Vivian, a distance of about 30 miles, in West Virginia.

This section of road is double track except for the Elkhorn tunnel, 3,000 ft. long, and there is also a large amount of third track or passing sidings, works sidings, &c.; the grades vary from 1 per cent. at the west end to 1·5 to 2 per cent. up to and through the summit tunnel, for 10 miles, followed by a short descent and 10½ miles of about ·25 per cent. up-grade and a final three mile ascent of 1·22 per cent. grade. Fully 60 per cent. of the line is curved, the maximum being about 12°.

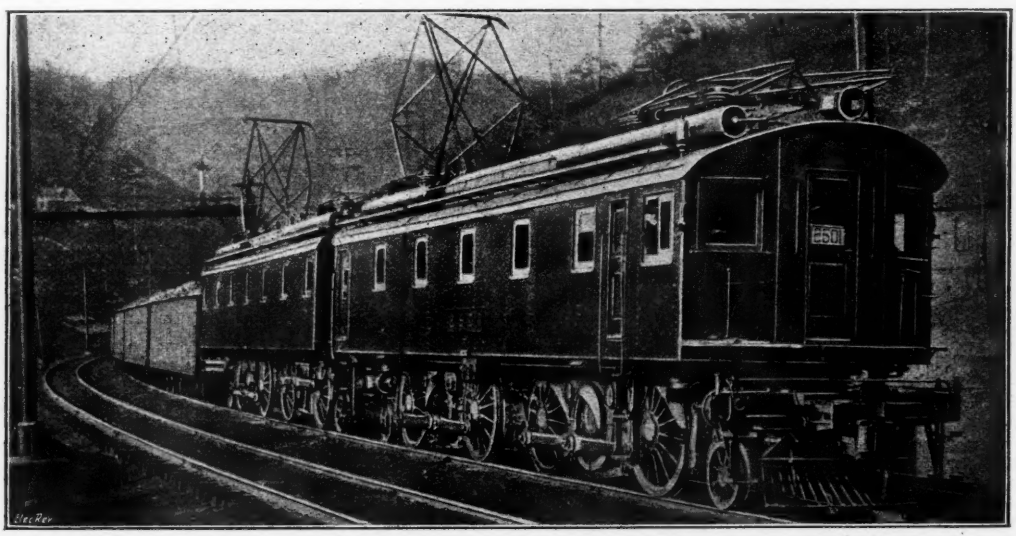
The east-bound traffic is very heavy, constituting the chief traffic, and all of it is handled by the electric locomotives which collect the coal from sidings and haul it over the summit to the classification yard at Bluefield.

In addition to heavy coal traffic, through merchandise and passenger traffic, which is still handled by steam locomotives, is assisted by electric locomotives as pushers up the grades.

A condition favourable to the electric locomotives is the possibility of despatching trains at uniform intervals throughout the day.

The electrification was undertaken primarily to increase the capacity of the line by reducing the time taken on the journeys, and heavy freight trains are now handled at 14 miles an hour, as against 7½ miles under steam operation; further, delays due to coaling locomotives on the grade are avoided. In the Elkhorn tunnel, running up grade, the steam speed was limited to six miles an hour on account of ventilation difficulties, requiring seven minutes to clear the block, which time is reduced to three minutes under electric operation.

Coal trains of 3,250 tons were handled up grade by three steam locomotives, one locomotive at each end of the train over the whole division, and the third as a pusher up the steep grades. The engines were heavy Mallet articulated compounds with machine stokers and superheaters. Under electric operation one locomotive handles the train except on steep grades where an extra pusher locomotive is required, and the speed has been approximately doubled.



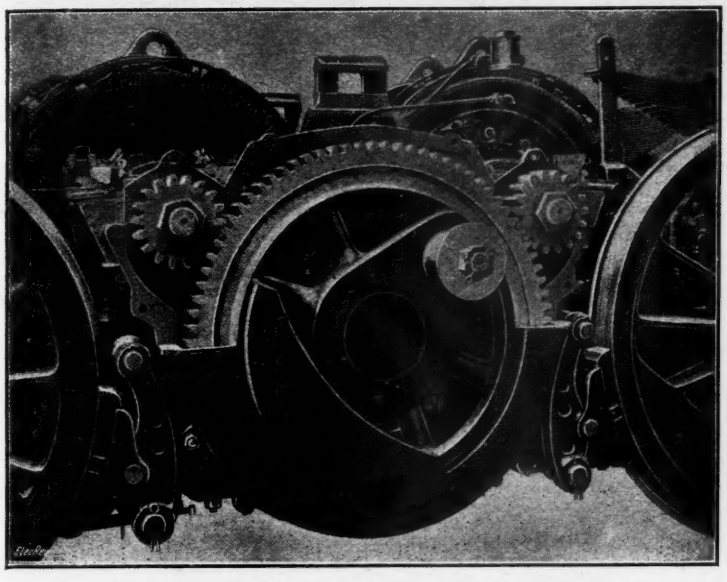
Norfolk and Western Electric Locomotive and Coal Train.

The electrical equipment, which was supplied by the Westinghouse Co., Pittsburgh, Pa., is designed to handle 20 tonnage trains a day of a total of 65,000 tons, and at the present time 12 such trains are handled in addition to the assistance given to through freight and passenger trains.

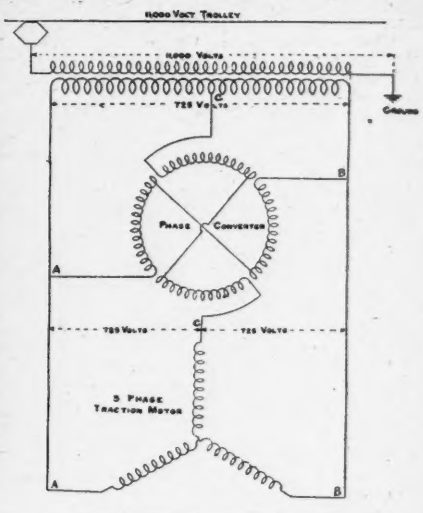
The line is supplied on the single-phase system, the trolley line pressure being 11,000 volts, 25 cycles. The locomotives, however, are unique in that they are equipped with phase converters, which in connection with the main step-down transformer on the locomotive, transform the single-phase current to three-phase current, which is utilised in induction type motors. Thus, while retaining all the advantages of high-voltage single-phase distribution and collection, the advantages of the three-phase induction motor on mountain grade conditions are secured, and it is feasible to adopt regenerative braking.

The latter system has, of course, been used on the Italian railways, but not for heavy freight train service such as obtains on American railways.

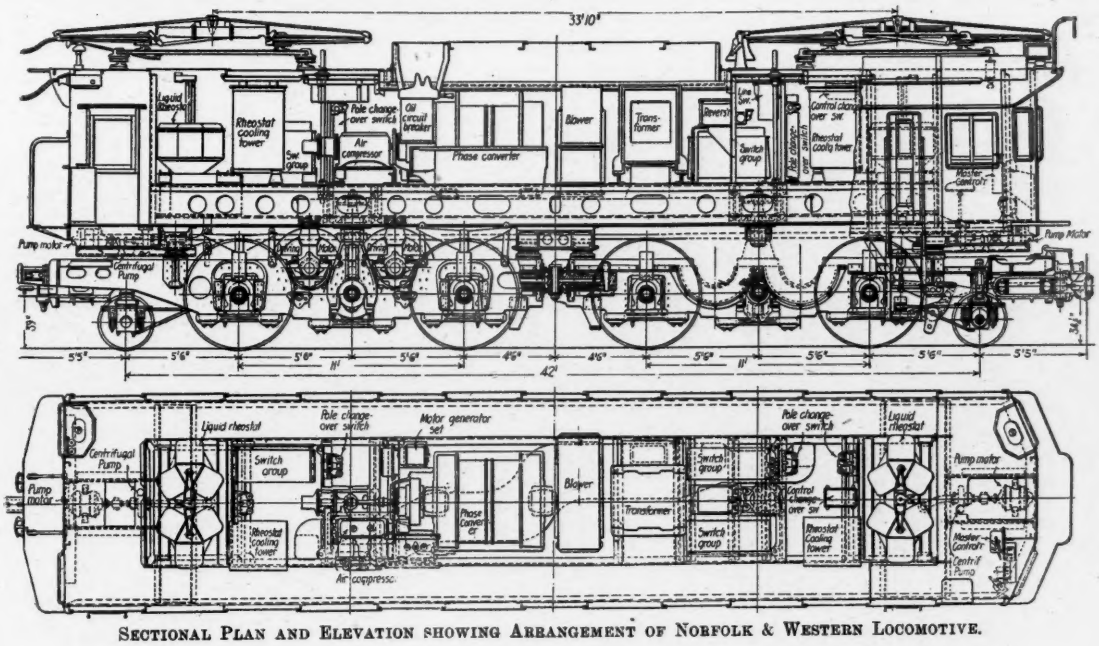
The feature has proved very satisfactory in service, the heaviest trains being handled down mountain grades at the uniform speed of about 15 miles an hour by a single locomotive with ease, the air brakes being held in reserve for stopping purposes.



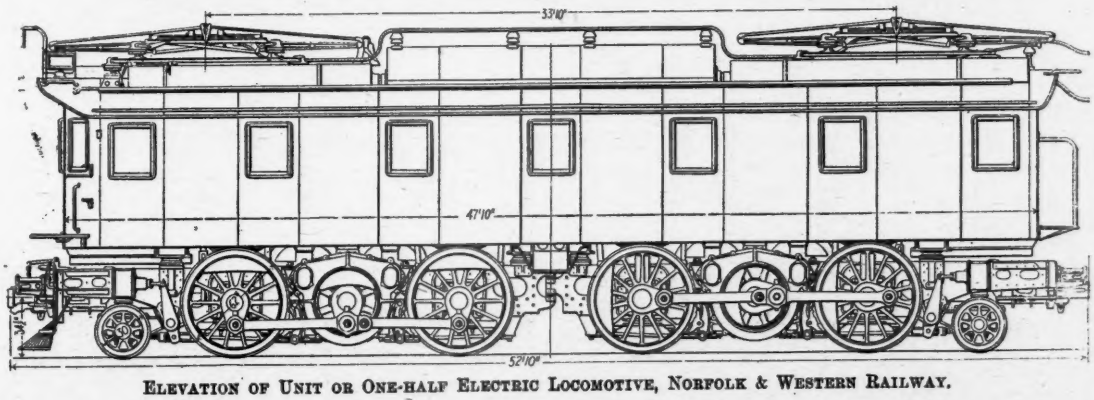
DETAIL VIEW OF MOTOR TRUCK, PARTLY DISMANTLED.




CIRCUIT DIAGRAM, FROM SINGLE-PHASE TROLLEY WIRE TO THREE-PHASE MOTOR, NORFOLK & WESTERN LOCOMOTIVE.




SECTIONAL PLAN AND ELEVATION SHOWING ARRANGEMENT OF NORFOLK & WESTERN LOCOMOTIVE.




ELEVATION OF UNIT OR ONE-HALF ELECTRIC LOCOMOTIVE, NORFOLK & WESTERN RAILWAY.

The traffic on the electrified division is handled by 12 270-ton electric locomotives, each consisting of two 135-ton units or halves. The mechanical portions were made by the Baldwin Locomotive Works and the electrical portions by the Westinghouse Co.

Each unit has two main trucks connected by a Mallet type hinge, and each main truck has two driving axles included in a rigid wheel base, with a radial two-wheel leading truck.

The cab is of the box type, with an engineer's compartment at one end of each unit, the two units being coupled to provide for operation from either end of the locomotive.

Each locomotive is equipped with eight three-phase induction driving motors, with wound secondaries for four and eight-pole operation; the motors are cooled by air forced from the main ventilating duct, which also delivers air to the phase converter and to cooling towers for the liquid rheostats.

There are two running speeds, 14 and 28 miles per hour.

In starting, resistance is inserted in the secondary circuit of the motor by means of a liquid rheostat; for both the 14 and 28 miles an hour speeds all the motors are connected in parallel, but with the 8-pole motor combination for the former and the 4-pole

motor combination for the latter. Unit switch type of control, arranged for simultaneous operation of the units from the control of either, is provided.

The 11,000-volt line current passes from the pantograph trolleys to the main transformers through an oil circuit breaker; the transformer secondary is connected to a phase converter, which runs continuously when the locomotive is in service.

The converter, which is coupled to a blower for supplying ventilating air for the equipment and to an air compresser, is an induction motor with a short-circuited or cage-wound secondary having two windings on its stator, one to drive the rotor and the other to furnish current out of phase with the main supply current.

The motor circuit of the primary winding of the converter is connected across the transformer secondary and receives current at 725 volts; the windings are so arranged that a current of 90° phase displacement is induced in the second winding on the primary of the converter and by connecting this displacement circuit to the middle tap of the main transformer a three-phase current is produced by the ordinary two-phase three-phase method of connection.

The converter is started from a direct-coupled, single-phase series commutator-type motor. On each unit are four liquid starting rheostats, one for each motor; each pair of rheostats has a storage reservoir and cooling tower, a circulating pump and one operating mechanism in common.

Each rheostat consists of a cast-iron tank, with two sets of metal electrodes connected to the motor and ground respectively, and a central hollow plunger which is raised or lowered to regulate the height of the liquid in the tank. Continuous circulation of the liquid is obtained, by a motor-driven circulating pump, between the reservoir and the tank, and the temperature is lowered by passing a portion of it through a cooling tower containing a series of trays arranged so that the liquid flows over them in a thin film and is cooled by air from the main ventilating duct. The air to the latter is supplied by the 36-in. fan coupled to the phase converter.

On the roof of each unit a couple of pantograph trolley collectors are mounted; these are raised by springs and lowered by compressed air, and are specially constructed to work in the restricted tunnel clearances.

The following table shows the performance of these locomotives under varying conditions of load:—

| | Train on 1·5 and 2 per cent. grades. | Train on 1 per cent. grades. | Train on 0·4 per cent. grades. |
|---|---|---|---|
| Weight of train—tons ... ... | 3,250 | 3,250 | 3,250 |
| Locomotives per train ... ... | 2 | 1 | 1 |
| Approximate speed, miles per hour ... ... ... ... | 14 | 14 | 28 |
| Drawbar pull per locomotive, pounds:— | | | |
| Uniform acceleration ... ... | 91,800 | 114,000 | 79,400 |
| At speed on 2 per cent. grade... | 75,400 | — | — |
| At speed on 1 per cent. grade... | — | 85,000 | — |
| At speed on 0·4 per cent. grade | — | — | 4,600 |
| Maximum guaranteed accelerating tractive effort per locomotive ... ... ... | 133,000 | 133,000 | 90,000 |
| Approximate maximum guaranteed horse-power developed by motors ... ... ... | 5,000 | 5,000 | 6,700 |

On tests and in service the locomotives have developed a drawbar pull considerably in excess of the guaranteed maximum, the highest record with the dynamometer car being 180,000 lb. This corresponds to an adhesion of about 40 per cent.

The electrified section of the Norfolk and Western line is supplied from a 30,000-KW. power station at Bluestone Junction, over duplicate 44,000-volt, 25-cycle, single-phase transmission lines, carried on the overhead line structures. There are five transformer stations of 28,000 K.V.A. installed capacity, in 44,000-11,000-volt, single-phase, step-down transformers.

The overhead line takes the form of single catenary, with an auxiliary messenger wire above the trolley, one main hanger being provided for every two intermediate connections between auxiliary and trolley wires on tangents. On curves the angularity of the hangers provides flexibility, and the auxiliary messenger and trolley wires are connected to the hanger at the same point.

On the main line the catenary is supported by steel structures, but in yards an overhead cross-catenary cable, attached to side poles, supports the running wires.

The catenary is hung from a steel casting attached to the overhead girder on tangent tracks, being supported by three suspension type insulators, each good for 11,000 volts, and 8 in. diameter by 5 in. long.

A malleable casting on the bottom insulator clamps the messenger wire—a ½-in. stranded steel cable; galvanised steel rectangular hanging straps, at 30-ft. intervals, to the bottom of which are bolted malleable iron trolley clips, hold the auxiliary messenger wire (on tangent track), and from the latter the grooved contact wire is supported by clips spaced 15 ft. apart.

The catenary supporting structures are nominally 300 ft. apart on tangent tracks and rather closer on curves, where the hangers are spaced at only 15-ft intervals, and due to the drag of the catenary system, the latter with the supporting insulators lies in an inclined plane. The catenary system is anchored or dead-ended at certain points, and in view of breakage of the messenger, the support under the insulator is designed to allow the wire to slip through at a certain pull and thus distribute the strain. The system being a regenerative one, special automatic switchgear and rheostats are provided at the power station to safeguard the running plant when excess power is returned from the line.

## CORRESPONDENCE.

*Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Electric Signalling in Mines.

With reference to the leading article on the above subject in your issue of the 16th inst., I fear that the writer of that article has fallen into an error in his statement, that "For every gaseous mixture there is a constant value of the product $Li^3$ beyond which the break-flash will be capable of igniting the mixture." True it is that the statement seems justified on the evidence from which the statement is drawn, but the evidence cited is only a particular case. When the inductance is extremely small on the one hand, or when no current and no spark passes as in a high-tension gap on the other hand, the formula does not apply, and yet ignition is obtainable in both these limiting cases. My experience of the subject leads me to the conclusion that when dealing with spark ignition it is necessary to distinguish between the energy which produces the spark and the ability of the spark to produce ignition. To the latter I have given the term "incendivity." Apparently the spark-producing energy is not a direct measure of incendivity, although there may be some relationship between the two quantities when certain other conditions are constant.

I am not able to deal with the matter fully here, as I hope shortly to present a paper to the Inst.E.E., in which this subject is considered.

**J. D. Morgan.**

Birmingham, *July 22nd*, 1915.

[Certainly ignition can be produced in the total absence of inductance; suitable gaseous mixtures can be ignited by sunlight, for example, but the article in question related to the range of conditions met with in mine-signalling, and was not intended to be applied to limiting cases. Mr. Morgan agrees that for the case considered the statement seems justified. It will be noted that the energy stored by inductance is proportional to $Li^2$, not $Li^3$, a fact which was referred to in the article, and which suggests that the electromagnetic energy is not the only factor concerned in producing ignition, though it appears to be the principal factor in this case. In view of the importance of the subject, we shall await Mr. Morgan's paper with great interest.—EDS. ELEC. REV.]

### "Autres Temps, Autres Moeurs."

Mr. Stevenson's letter, published in last week's ELECTRICAL REVIEW, is particularly interesting, in that it shows that the American manufacturer takes up that very attitude with customers, which you and other Editors have so long decried as "Antiquated British"; you will note that any customer who wants to place an order for insulated wires and cables in the States must take American standard stuff, must take American gauges, and must not even ask for quotations for the sections he has been used to; moreover, he must pay cash in New York against shipping documents.

May your publishing this letter be taken as a sign that the war is causing you to alter your views, even as it is causing Mr. Harold Cox and others to see that it is necessary to be economical and check imports as much as possible now that they and other financial magnates are beginning to feel the stress and pinch of lack of money, just as the manufacturing working classes have felt it in the past?

Is it possible that the manufacturer will at last be considered of really more importance than the merchant, the banker and the lawyer, for whom and by whom our laws are made?

**P. R.**

[In a few lines our correspondent contrives to raise half-a-dozen diverse and independent questions. Taking them in order: (1) Publication of a letter in our pages has not the slightest bearing on our views; our "Correspondence" columns are written by our readers, and reflect their views, not necessarily ours; (2) with regard to the relations between manufacturers and purchasers, our contention, based on abundant evidence, has been that British firms are apt to adopt a "take it or leave it" attitude, whereas the Germans sedulously inquire into, and lay themselves out to comply with, the needs and wishes of their customers, with the result that trade has been passing from us to them for years. The Americans, as we have pointed out by quotations from their own Consular reports and other evidence, are as culpable as the British in this respect, and Mr. Stevenson's letter bears this out; (3) in the future, after the war, German competition will be redoubled in intensity and virulence, and it will be still more urgently necessary to meet it by consulting the interests of foreign purchasers; (4) we are not responsible for "Mr. Harold Cox and others," but we have always advocated that preference should be given to British manufactures; (5) the war has revolutionised conditions throughout the world of industry, and whatever economic principles may have been supported by ourselves and others in pre-war times, we and they are under no obligation to maintain them under the new *régime;* (6) with the suggestion contained in the last paragraph of our correspondent's letter we are, and always have been, in hearty sympathy. Our aim has always been to promote the interests of the electrical industry.—EDS. ELEC. REV.]

### Shop Window Lighting.

In December last I sent a letter to your paper in regard to shop window lighting in war time, dealing with the amateurish attempts made by shopkeepers to conform to regulations. I drew attention to the much favoured method of wrapping tissue paper around bare lamps, and pointed out that this not only was very ineffective but was a distinct source of danger, as witnessed by the large amount of badly-scorched tissue paper seen.

The note of warning which I struck in that letter was amply justified in the Press this week, where it was stated that the L.C.C. Fire Brigade was recently called to an outbreak of fire caused by crinkled paper round electric lamp bulbs in a shop window. One is led to wonder how many small outbreaks, not necessitating the attendance of the fire brigade, have been caused by this highly dangerous practice. The system I mentioned in my December letter was the scientific lighting of shop windows by means of concealed lighting units placed high in the window. This method ensures the effective lighting of the articles displayed with complete control to accord with the lighting restrictions of the police—and has the additional merit of being safe and free from danger of fire. A large number of shops have been lighted on this approved plan and give absolute satisfaction to all concerned.

**F. Willcox,** *General Manager,*
Lamp and Wiring Supplies Department,
The British Thomson-Houston Co., Ltd.

London, E.C., *July 24th*, 1915.

### Branch Offices.

Amongst the many whose consciences claim exemption for them from joining the Forces are, I expect, the heads and staffs of the many branch offices in the country. Now, the release of these men—and a fine useful haul it would be—depends upon their firms. To the general public it does not matter which firm supplies, and branch offices in these times cannot surely speed up the delivery of goods. In fact, if the local competition were removed and matters dealt with from headquarters, it would probably save the time of both buyers and sellers.

**Erimus.**

MR. JOHN E. GRAY.—The matter referred to in your letter has already been dealt with in several of our issues, and we think no useful purpose would be served by discussing it further.—EDS.

## LEGAL.

### HAMILTON *v.* MARCONI'S WIRELESS TELEGRAPH CO., LTD.

(*Continued from p.* 108.)

THE hearing was resumed on Thursday, July 22nd, when

MR. CAPPALARE was recalled with regard to certain agreements and other documents, amongst them being letters from the Admiralty to the company, and the company's reply to one of them dated October 18th, 1912, relating to the Australian arrangement.

MR. POLLOCK, K.C., said that they had had to get the letters from the Admiralty, and he thought in the public interest they should not be made public. He mentioned this as he noticed that a report of the case was appearing in the ELECTRICAL REVIEW. It was a matter of some importance that these things should be treated as confidential.

MR. GORDON HEWART, K.C., said he quite agreed with Mr. Pollock's remarks, and would not ask that the letters should be read.

The WITNESS, in answer to MR. STUART BEVAN, said he produced the company's correspondence with Mr. Fisk as to the supply of the apparatus. Mr. Fisk, he said, was the company's resident agent in Australia, and the company from time to time furnished him with apparatus and materials for the purpose of the company's business, which he was carrying out there. In the correspondence he asked to be supplied with certain apparatus which he thought ought to be stored in Australia, and accordingly some sets were shipped to him on May 13th, 1912, and debited to the Sydney Stores account. One of those sets was for the ship *Manpouri*, which was fitted in Australia, on July 18th, 1912. That was one of the vessels on which commission was allowed to Mr. Hamilton, and included in the money paid into court. It was one of the Union Steamship Co.'s vessels. On August 27th Mr. Fisk wrote asking if it would be possible to send out a good supply of ship sets so that there might not be a rush at any time. On October 5th witness wrote him that five emergency sets would be placed on order, and they were sent accordingly.

The WITNESS produced a list showing apparatus from time to time sent to Mr. Fisk to the value of £3,534, which amount, he said, represented the apparatus remaining at the stores in Sydney, and disposed of by Mr. Fisk when the agreement with the amalgamated Australian company was entered into. Included in the amount, however, were the fittings for two ships, which had been taken from the stores. The company never agreed to pay the plaintiff for them, as the contract was made at an earlier date.

In answer to MR. GORDON HEWART, in cross-examination as to the wireless chain, the witness referred to the reply of the Government in relation to the matter and the statement that they did not propose to proceed with it, when MR. POLLOCK objected to the letter being produced in evidence.

The REFEREE, after some argument, said he would admit the letter, as it was important to know what the company had to say to the decision not to proceed with the Imperial wireless chain.

MR. POLLOCK said that under the circumstances he would have to consider what course he would adopt. There was evidence that none of the stations contemplated had been built. The only way in which it could be material, was that it fell under the branch of the claim as to whether there was a sale effected within the plaintiff's territory, and the defendants said that the period of the agreement was not the term of his natural life, but the term of three years. That which came under the agreement of July 13th was not material, unless the Referee came to the conclusion that plaintiff was entitled to something for the rest of his natural life. Then the question would be whether he was entitled to make any claim in respect of damages for that which had taken place between the Marconi Co. and the Postmaster-General. If he was entitled for his natural life the matter could be gone into when the Referee had made up his mind upon the point, and he (Mr. Pollock) would then have to consider whether he would on behalf of the Marconi Co. reopen that matter.

MR. GORDON HEWART said his answer to that was twofold. In the first place, Mr. Pollock had put in a certain letter, and there was an answer to that letter. Having put the letter in he could not say that the answer to it was not relevant. The letter without the answer might be misleading. In the second place, Mr. Pollock suggested that the plaintiff's claim in respect of that document depended upon his submission that the commission was for the life of Mr. Hamilton. There was a contract made, which, if it had been performed by the defendant company, would have undoubtedly yielded a large commission to Mr. Hamilton. Mr. Hamilton said that so far as he was concerned, he did all his part, and if the matter did not go on, the fault was with the company.

MR. POLLOCK suggested that if, after considering the matter, the Referee thought he ought to produce the correspondence, he would do so; they might have a further sitting in order to discuss the matter.

MR. GORDON HEWART said he did not profess to know how much real substance there was in the question of publicity, but he would take whatever course the Referee might think right in regard to the letters.

MR. POLLOCK said he would accept that position, which he thought very fair on the part of Mr. Hewart, and he would send for the letters in order that the Referee might see them.

MR. CAPPALARE, in further cross-examination, said that the separate apparatus was sent to Sydney in accordance with Capt. Fisk's request. It was sent on February 20th, 1913, and the price was £166 16s. On April 27th there was a telegram from Sydney, asking to have other sets sent, part of which were sent—two on the 18th and two on May 28th. The Crown agents would not tell for what stations they required the spare stores. Whatever spares might have been sold for the stations would be included in the statement of commission due to Mr. Hamilton.

MR. WM. WALTER BRADFIELD, the manager of the defendant company, examined by MR. POLLOCK, said that the Admiralty from time to time ordered supplies of apparatus to be sent to the naval stores at different places, but he had never known the orders to specify the particular ships in which the apparatus was to be fitted, nor was it possible for the company to ascertain the place at which the apparatus was to be used. He had no documents, beyond those disclosed, in reference to the battleship *New Zealand*. The Malay States battleship had not been completed, and he had no documents relating to her. His company had never, to his knowledge, supplied apparatus to be fitted in the Australian battleships, but it was quite possible that some of the apparatus supplied to the Admiralty had been fitted to those ships. The company never asked the Admiralty what they did with the apparatus supplied to them. Besides the letters which had been produced there were no other documents relating to the Australian battleships. All orders passed through his hands or were brought to his notice before they passed into the company's books, so that he would know what documents existed. There were eight field sets for Australia in all, and the orders for these came from the War Office. In those orders there was an indication that they would be paid for by the Commonwealth of Australia, but he did not remember that their destination was mentioned. Altogether there were 12 field sets, four of which were for the War Office and eight for Australia. Four of the eight were ordered on January 25th, 1913, and they had not paid the plaintiff in respect of those. He did not know where the other four went to.

In cross-examination, MR. GORDON HEWART produced certain letters which he submitted to the witness with the observation that he did not wish to read them aloud owing to circumstances which had already been stated. After the witness had inspected the letters, he said he had never had any communication with the Admiralty with regard to supplying apparatus for the Australian ships.

A letter and a reply which followed it from Mr. Godfrey Isaacs were submitted to the witness, and he was asked by Mr. Hewart whether after having read them he had any doubt that the apparatus installed in the Australian ships were apparatus manufactured by the Marconi Co. Witness replied that he should think it very unlikely that any considerable portion would be manufactured by the company. The proportion would be very small.

In further cross-examination, the witness said he did not think the company were supplying complete apparatus since 1899 or 1900. They had supplied particular portions of the apparatus.

MR. HEWART: An important part of the installation is called

the condenser, is it not?—Yes; we supply condensers and detectors, or receivers, as we should call them, to the Admiralty for use on board ships.

MR. HEWART: I suggest that the price of a condenser and receiver would be about £100 a ship?—No; the price would be from £10 to £17 for a detector and condenser.

Do you suggest that the price of a condenser and receiver would not be more than £17?—Certainly. I cannot say the price of an Admiralty set, because I do not know how they are made up.

You know, if you supplied it, the cost of a set would be about £400?—That would depend upon the size of the installation. Some are more powerful than others. A small one would be from £100 to £500, and for larger ships the cost would go up to, and beyond, £1,000.

Supposing it were held that Mr. Hamilton was entitled to commission upon the apparatus supplied by you to the Admiralty, do you not think you could ascertain from your books, and inquiries at the Admiralty, the price of the parts of apparatus you supplied?—Our books would not tell us, and I do not think the Admiralty would give us any information on the subject.

Continuing, the WITNESS said that the New Zealand and Australian ships were equipped to a slight extent with apparatus supplied by the Marconi Co. No doubt it would be possible to find what was the total amount of business done with the Admiralty during the year, but there were no records of the names of the ships. The orders came from the Admiralty to the company to send the apparatus into one or other of the stores. He had a conversation with Mr. Hamilton before he went to Australia, as to calling upon certain shipping agents in London, and he understood that he was already in touch with the shipping houses in Australia, but he (Mr. Hamilton) was not largely interested in raising the subsidy from £200 to £250 per annum.

MR. POLLOCK said that that was the defendant's case, and he submitted the correspondence with the Admiralty to the Referee for his private perusal.

The REFEREE, after having read the letters, said they did not show that there was anything likely to follow which would be material to the case.

*(To be continued.)*

[After hearing the addresses of counsel, the Referee reserved judgment.]

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### ATTWELL *v.* WEST HAM CORPORATION.

IN the Bow County Court, on July 21st, before his Honour Judge Smyly, K.C., there was the fourth day's hearing of the action for damages brought under the Employers' Liability Act, 1880, by Arthur Edwin Attwell, an electrical labourer, against his former employers, the West Ham Corporation, for injuries received in an explosion in a transformer chamber.

Mr. C. T. Williams appeared for the plaintiff, and Mr. Kingsbury for the defence.

The man's duties were to go round the various transformer chambers and see that everything was in order. One day in April, when at Messrs. Suter, Hartmann's premises, there was an explosion, and he was badly "shocked" and his arm was burned. He had been unable to work since. He was never provided with rubber gloves. He had no technical electrical knowledge, and knew very little as to what was right or wrong to touch in a transformer chamber. He denied that he had said he had been in the employ of other corporations in their electrical works, or with firms, in the same position. For five years before going to the defendants he had been a ship's steward, and prior to that a barman. He had not the slightest training as an engineer, and when he entered their employ he was paid 30s. a week to carry tools. He was always under the supervision of Mr. Leece, the foreman. After the accident he used to go round the electric chambers, and report to the foreman as to their condition, but he never did any work; it was impossible, as his hand was dead. His reports seemed to show that he had been working, but he was asked to fill them up like that by the foreman. When with the men on these occasions he used "to tell tales, crack jokes and sing songs."

JUDGE SMYLY: It must be very pleasant to be in the employ of the West Ham Corporation.

This closed the plaintiff's case, and Mr. KINGSBURY, for the defence, said he would be able to call a witness to prove that, so far back as 1907, Attwell was a clever electrical assistant with technical knowledge, and was employed in erecting sub-stations on consumers' premises. When he asked for employment from the defendants it was as a skilled man, competent in all branches of electricity. On the day of the accident Attwell did not use the gloves that had been provided for him, besides which he tried to do work which should only have been done when the foreman was there. He worked after the accident, and then started staying away, which was put up with for a time, but finally the Corporation decided to put an end to it.

DR. ANGUS KENNEDY said that on May 2nd the plaintiff was a perfectly sound man with the exception of tremors of the fingers, due to cigarette tobacco poisoning, as indicated by the stains on his fingers. There was no evidence of electric shock.

DR. HUGH WALSHAM, who had made a special study of electricity from the medical side, said the man could not have had a 6,000-volt electric shock, or he would have completely collapsed, instead of walking away as he did.

WM. LIONEL LEECE, electricity foreman to the defendants, said he engaged plaintiff as a handyman and assistant. He showed him round the chambers, and told him what he must touch and what not. Gloves were provided for him. There was ample proof given by the man that he had technical knowledge. He had operated high-tension switches, and when plaintiff swore he did not know how, he was telling an untruth. Where the explosion occurred was behind the rail, where plaintiff had no right to go, as he knew, without witness being there. When he was called he found signs that a pot-end had been fusing. On the insulating stool he found plaintiff's bag, with his rubber gloves in it. Later he saw the plaintiff, who said he felt quite all right. He questioned him about the gloves, and plaintiff said he forgot to use them.

The case was again adjourned.

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### WORKMEN'S COMPENSATION.

AT the Warrington County Court, on July 22nd, Mr. Cellers, deputy judge, gave an award under the Workmen's Compensation Act on behalf of the widow of George Peplow, foreman shunter, late of Mill Street. Deceased was killed by a crane while in the employ of the St. Helens Cable Co., Ltd., and a claim was made on behalf of the widow and five dependents for £256. The company offered £189, but a compromise had been made, and they had paid £220 into Court. The compromise was arranged because there was some doubt as to what the wages of the deceased were to be, he having only been in the firm's employ for one day before he was killed. The present application was for an award of the £220 paid into Court; and the St. Helens Cable Co. consented to this award and applied for an indemnity against Messrs. J. Dolan and Son, builders, Napier Street, on account of a legal liability by them through deceased having been killed by their crane, which was working on land adjoining the cable works. The firm of Dolan consented to the indemnity, and an award was made on these terms, with costs on scale B.

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### SMOKE PROSECUTION.

ANOTHER summons against Messrs. Connolly Bros., cable manufacturers, of Mill Brow, Blackley, was heard at Manchester City Police Court, on July 21st, in respect of the emission of black smoke from their chimney. Defendants were fined £3.

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### A CONSULTING ENGINEER'S CONTRACT.

JUDGMENT has been issued by Lord Hunter, in the Court of Session, in an action in which Thomas Crichton Fulton, consulting engineer, Glasgow, sued the Govan District Board of Control for payment of £216, in respect of professional services rendered by him to them.

In February, 1912, the defenders decided to introduce electricity at Hawkhead Asylum, for certain purposes. The pursuer was appointed consulting engineer for the defenders in connection with the carrying-out of this work. He was to discharge his duties for a sum of £155. The work was finally completed for a less sum than the contract amount. The pursuer had been paid the £155 for which he contracted to do the work, and the sum for which he now sued—which was largely in excess of the contract sum—was alleged to be due in respect of extra work done by the pursuer, for which he was entitled to special remuneration. The defenders pleaded that the pursuer had not performed any duties for them except those of consulting engineer under his contract, and was not entitled to make any additional charge. The defenders admitted that the pursuer had taken a good deal of trouble in connection with the Clyde Valley Co. agreement, and to cover that they tendered £40.

LORD HUNTER gave decree for £40, with expenses to the date of the tender, March 9th, 1915. From that date the defenders were found entitled to expenses.—*Edin. Evg. Dispatch.*

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### DISSOLUTION OF PARTNERSHIP.

A SETTLEMENT was announced to Mr. Justice Astbury, in the Chancery Division, on Tuesday, of an action by Wm. Francis Morris, of 11, Arundel Square, Barnsbury, against George Edward Tate and Frank Oliver Monkhouse, carrying on business in partnership with the plaintiff as the Acme Arc Lamp and Engineering Co., Kentish Town, claiming dissolution of the partnership.

MR. KINGHAM, for the plaintiff, who had joined H.M. Forces, said he was 24 years of age, and he asked for dissolution of the partnership under an agreement of September, 1913, and the usual accounts.

His LORDSHIP said the plaintiff had put into the business £250, and he could not now continue in the business. He thought he should be treated generously.

After the parties had had a conference, MR. DILL said they had come to terms which they would embody in a consent order for dissolution as regarded the plaintiff as from that day; the defendants to retain the assets and to indemnify the plaintiff against the liabilities of the firm; the defendants to pay the plaintiff £200, £50 now, and the balance by three instalments at two, four, and six months, with interest; no costs on either side; and a stay of all proceedings.

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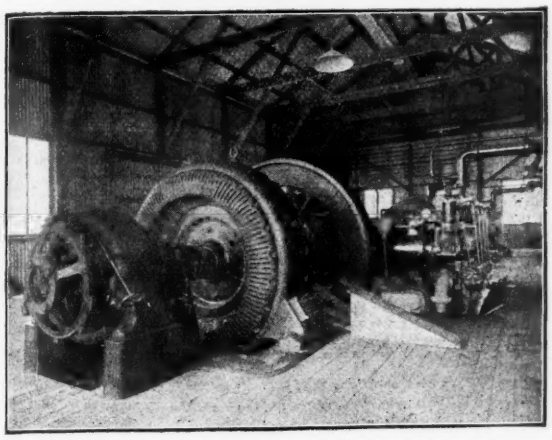
**An Electrical Mosquito Exterminator.**—An electrical engineer has discovered that mosquitoes are attracted by a certain note in harmonic telegraphy. He covered the machine with fly-paper, and the mosquitoes were lured to their death by the musical note. He has also found a way to electrocute the insects by using the same note.—*T. and T. Age.*

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Electrical Driving in Cement Works.

The extensive application of electricity for driving cement works machinery obtains in the Oversea Dominions just as much as in this country. A recent installation of electrical plant for this purpose is that of the Adelaide Cement Co., of Adelaide, N.S.W. Gas engines were selected for the prime movers, the installation consisting of two 380-H.P. four-cylinder horizontal gas engines, running at 214 R.P.M., and manufactured by the Premier Gas Engine Co., of Sandiacre, coupled to 275-K.V.A. "Witton" alternators, supplied by the British General Electric Co., Ltd., of Sydney, and constructed at Witton, Birmingham. The gas producers were manufactured in South Australia by Messrs. Clutterbuck Bros. from designs prepared by their consulting engineer, Mr. W. S. Saunders.

Power is supplied to the works motors at 440 volts, 50 cycles, and the generators are designed for a power factor of 0·725. There are several interesting features about this installation. In the first place, the two units run in parallel without the slightest trouble.



"WITTON" ALTERNATOR DRIVEN BY "PREMIER" GAS ENGINE.

This is said to be the only plant in Australia in which three-phase gas-driven alternators are run in parallel. Not only do the sets run satisfactorily in parallel at no load as well as at full load, but they run well when one of the cylinders is cut out.

A second point of interest is the low fuel consumption. On the official tests, the weight of fuel consumed per KW.-hour was 1·22 lb., the fuel used being gas coke. This performance was nearly 25 per cent. better than the guarantee.

With regard to governing, during the official tests full load was thrown off the engines and then switched on again; in both cases the engines showed no appreciable variation of speed.

The electrical side of the contract was arranged, and the plant installed, under the supervision of Messrs. Colton, Palmer and Preston, who are the Adelaide agents of the British General Electric Co., Ltd.

### Tungsten for Telegraph Keys.

A modest but very essential part of a telegraph key has recently received the attention of an American manufacturer of telegraph apparatus and been really improved. The little platinum contact points, which have frequently been charged with being the cause of bad sending and been pounded into a shapeless mass by glory-seeking young operators, are being displaced by tungsten, which is taking a very prominent place in the manufacture of electrical devices.

Tungsten has proved to be a distinct advance in key construction. The points never stick or corrode, and they are practically indestructible. They are, moreover, much cheaper than platinum points, which is an important consideration. The platinum used in keys is one of the most expensive items of cost in manufacture, the value of the metal required for each key being, at present, between 40 and 50 cents for standard requirements. Tungsten points can be made for less than one-half the cost of platinum, and this price will, no doubt, be reduced with improved methods of manufacture.—*T. and T. Age.*

## WAR ITEMS.

**Trade Openings Abroad.**—ECUADOR.—An agent in Guayaquil wishes to represent manufacturers of electrical goods. Applications should be made, in the first instance, to the Board of Trade Commercial Intelligence Branch in London, and, subsequently, to the British Consulate, Guayaquil.

ITALY.—A firm with branches at Florence, Geneva and Turin, wishes to secure representation of United Kingdom manufacturers of porcelain (or substitute) fittings for electrical gear, such as insulators (high and low tension), bobbin insulators, pulleys, and bases for fuses. Applications should be made to the Board of Trade Intelligence Branch in London, and, subsequently, to the British Consulate, Milan.

An Italian firm, through Messrs. Wm. Geipel & Co., is inquiring for insulating material in the form of sheets, sticks, &c., as a substitute for ebonite and vulcanised fibre at a low price. We will forward the address to firms interested in the subject.

**The Situation in Belgium.**—A German engineer, who is employed in connection with the civil administration in Belgium, reports that the engineering industry in that country is passing through gloomy days, although some makers of lathes and agricultural machinery are at work. A similar remark applies to the electrical engineering industry. Hardly any new machines are being made in the various works, where repairs of rolling stock are being carried out. The electricity supply and gas works have of necessity been compelled to restrict working, the street lighting is reduced, and light industries are less active than was formerly the case. Most of the electricity and gas works belong to private companies, which hold concessions from the local authorities. The Municipal Council of Brussels—greater Brussels consists of a number of independent communes—owns the gas and electricity works, except for certain districts. On the other hand, the (English) Continental Gas Co., to which belong the gasworks at Berlin and Hanover, furnishes gas and electricity to a number of the communes in Greater Brussels, as well as gas at Antwerp. The scarcity of coal which prevailed last winter has been overcome, and the stocks have been replenished, so that, if the deliveries continue, an interruption in the lighting service is not apprehended in the coming winter through the lack of coal. It is added that the light and power stations are employing almost the same number of workers as in peace time, and that the number of connections has increased owing to the total cessation of supplies of petroleum.

**Shell-Making at ————.**—Mr. V. Delebecque informs us that in his district a Committee was formed three weeks ago to look into the matter of the production of shells, of which he is a member, and his assistant, Mr. Blandford, is hon. draughtsman: in the short time which has elapsed a number of lathes have been selected, the attachments for them have been arranged for, a suitable building for housing them has been found, and in all probability within the next month a factory capable of turning out a large number of 4·5 shells a day will be in full operation.

**British Insulated & Helsby Cables, Ltd.**—In the course of a recent reference in this column to the work that this company has in hand, it was stated that some orders had been transferred to the United States; we have since ascertained that this statement was erroneous, as no such transfer of orders has taken place, and we withdraw it unreservedly.

**Wireless in the War.**—Signor Marconi, who is a Lieutenant in the Italian Engineers, has been in London for a short stay, on important business. He states that the Italians are using wireless telegraphy freely in the field, for directing the fire of big guns, and that wireless telephony has been found of considerable use at sea, particularly in the British Navy.

## BUSINESS NOTES.

**Holidays.**—The factory of the "Z" ELECTRIC LAMP MANUFACTURING CO., LTD., at Southfields, S.W., will be closed for August Bank Holiday week (from 2nd to 7th inclusive). A small staff will deal with urgent matters.

The factory of the "OMEGA" ELECTRIC LAMP CO., LTD., at Hammersmith, will be closed from Monday, August 2nd, to Saturday, August 7th, inclusive, for the annual holiday.

MESSRS. J. H. TUCKER & CO.'S works and offices will be closed from Friday night, the 30th inst., until Wednesday morning, August 4th.

**Prices Advance.**—THE LIVERPOOL ELECTRIC CABLE CO., LTD., of Linacre Lane, Bootle, announces altered discounts to the trade for Association and non-Association rubber-insulated wires and cables, consequent upon the continued advance in raw materials.

**Liquidations and Dissolutions.**—BRYANT TRADING SYNDICATE, LTD.—This company is winding up voluntarily, for the purpose of reconstruction, with Mr. A. C. Vincent, of 10, Pancras Lane, E.C., as liquidator. A meeting of creditors is called for August 3rd.

ALUMINIUM PATENT NONFLUX SOLDER.—A meeting will be held on August 26th, at 10, Camomile Street, E.C., to hear an account of the winding up from the liquidator, Mr. C. Waterhouse.

BESSEMER & REDMAN, Newton Abbot and Torquay.—Messrs. Robert Redman & H. A. Bessemer, electrical engineers and contractors, have dissolved partnership as from December 31st, 1914. The business will be carried on by H. A. Bessemer, who will attend to debts.

**Outing.**—A number of the employés of the ANCHOR CABLE CO. had an enjoyable outing a few days ago to Gathurst, where tea was served and a bowling match was played.

**Trade Announcements.**—MR. WM. PALMER, of 386, Fulham Palace Road, S.W., has resigned his position as sales manager with the Anglo-Colonial Engineering Co., Ltd., 13, City Road, E.C., and by mutual arrangement with the company has withdrawn the agency for motors made by the Nya Foerenade Elektriska A. B. Ludvika, Sweden, from their business, and is working it on his own account from the above address. He holds good stocks of standard machines.

MR. FRANCIS HUSBAND, A.M.I.E.E., late director of Electrical Contracts and Maintenance Co., Ltd., has been appointed managing director of F. Husband, Ltd., and all inquiries should be addressed to the firm at Craven House, Kingsway, W.C. The business carried on will be electrical manufactures and supplies to the trade.

MR. GEO. B. CROCKATT has entered into a working arrangement with Messrs. Douglas Primrose & Co., 163, Hope Street, Glasgow, and has transferred to that firm the agencies which he held on behalf of Messrs. Frankenburg & Sons, of Salford, and the Jackson Electric Stove Co., of London. Messrs. Douglas Primrose & Co. have a special office staff and ample store room for dealing with agency work.

THE WALSALL ELECTRICAL CO., LTD., 57, Bridge Street, Walsall, inform us that they have been placed on the War Office list as suppliers of small meters as used on charging boards and in connection with signalling apparatus.

**Trade between the U.K. and Russia.**—An arrangement has been concluded between His Majesty's Government and the Russian Government for the reciprocal waiver of Consular fees in connection with the issue and legalisation of certificates of origin for goods sent from the United Kingdom to Russia, and *vice versâ*. This arrangement is to come into force on August 1st. —*Financial News.*

**Catalogues and Lists.**—MR. SHERARD COWPER-COLES, 1 and 2, Old Pye Street, S.W.—Leaflet describing the Cowper-Coles regenerative electro-galvanising process for depositing zinc on iron and steel.

THE HOMOGENEOUS LEAD COATING CO., 1 and 2, Old Pye Street, Westminster, S.W.—Illustrated circular respecting their homogeneous protective lead covering for iron and steel surfaces.

M. PAUL GADOT, Porte Champerret, Levallois-Perret (Seine).—Catalogues Nos. 1 and 2, with supplement, describing the Paul Gadot accumulators, and electric lighting apparatus for automobiles, &c.

MESSRS. HAYLOCK & HASLETT, 63, Queen Victoria Street, E.C. —Leaflet showing the "Penlite" flash light, for the waistcoat pocket.

ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, S.W.—The following new E.A.C. leaflets have been issued:—H17A (Field Regulators) superseding H17; H19P/1 (D.C. Pillar Panels) superseding H19P; H24/1 (D.C. Multiple Lever Starters) superseding H24; H25 (D.C. Automatic Control Gear) superseding H25/1, H25/a, H25b, H26/1, H27; H40/1 (Ironclad Switchgear) superseding H40; H41/2 (Ironclad Switchgear) superseding H41/1; H42/2 (Auto-Transformer Starters) superseding H42/1; H43/2 (Star-Delta Starters, &c.) superseding H43/1; H44/1 (Slip-Ring Motor Starters and Controllers) superseding H44; H45/1 (A.C. Motor-Control Units) superseding H45. Leaflet H29 has been withdrawn from circulation. The leaflets are fully illustrated, and contain tabulated data relating to dimensions, shipping weights, prices, &c.

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End, Middlesex.—Leaflet No. A 3,112, describing "Ediswan" circuit-breakers, types W and E, with prices; also revised booklet on "Ediswan" "Kingolite" patent upright candle lamps, shades, &c., and a leaflet on Ediswan electric fans.

THE CRESSALL MANUFACTURING CO., 40 and 41, Staniforth Street, Birmingham.—Card illustrating woven asbestos resistance and heating nets, with sample attached.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list No. 5,111 on air-break Y-Delta starting switches for use with three-phase squirrel-cage induction motors up to 25 H.P.

CAMERON SALES-ORGANISATION, 9-10, Southampton Street, W.C.—Leaflet describing the "Junior" bell-ringing transformer and porcelain clamp bushing.

MESSRS. DAVID ROWELL & CO., LTD., 33, Old Queen Street, Westminster.—Reference list of fencing, staircases and constructional steel and iron work.

THE NEW SYSTEM PRIVATE TELEPHONE CO., LTD., 143-145, Great Portland Street, W.—Postal card *re* "intercommunicating telephones."

**Licences to Trade.**—The following statement by the War Trade Department in regard to the granting of licences to trade has appeared in the *Times*:—

"All applications for licences, of which a very large number, about 2,000, are received each day, are registered and then sent to the Trade Clearing House. The Trade Clearing House has collected and collated a huge mass of information about trading firms, especially in neutral countries. This House reports as to whether there is anything against either the consignor or consignee, and no application is considered without reference to this information. Many of the applications go next to a Government Department, *e.g.*, the War Office, the Admiralty, the Board of Trade, the Board of Agriculture, the Ministry of Munitions, and are then referred to a special sub-committee when such a sub-committee exists. No licence is granted in these cases without a recommendation from the Department or sub-committee concerned, and no licence is ever granted against a recommendation to the contrary from those quarters.

"The work of the War Trade Department is thus carried out with exact and scrupulous care. All possible dispatch is exercised, but a careful investigation of an application for a licence is not always compatible with great speed. Mistakes no doubt do occur, but it is claimed that they are few in number, and that every possible care is taken to prevent them. The strictest oversight and supervision are exercised."

**Book Notices.**—*The Universal Directory of Railway Officials*, 1915. Compiled under the direction of S. Richardson Blundstone. London: The Directory Publishing Co. 10s.—This directory has now reached its twenty-first year of publication. The sectional arrangement of the contents is, as usual, convenient, but the war has naturally had its effect upon the directories which deal with undertakings on the Continent. The editor announces that the war has made it necessary to omit the sections relating to the railways of Austria, Germany, Hungary, and Turkey, and for the same reason the sections relating to the railways of Belgium and certain parts of France have not been corrected. The information relating to the railways at home and abroad, also the tramways in the United Kingdom, and their *personnel*, is revised as usual, and altogether the directory is a very useful one for those who have dealings with the great railway systems of the world.

*Manual of Electrical Undertakings and Directory of Officials*, 1915-16. By E. Garcke. London: Electrical Press, Ltd. 21s. net.—The nineteenth annual edition of this well-known work contains all its usual features particularising the electrical undertakings of this, and many other countries, their finances, and their *personnel*. Altogether it consists of 2,000 pages and contains 48 maps. One of the latter is a large revised map of the United Kingdom, showing the situation of all lighting, power and traction undertakings. The "Survey of the Year" contains a good deal of comment relating to the war and war effects upon electrical undertakings, and a couple of articles describe the electrical position in Belgium and Germany as it was before the war.

"The *Engineer* Directory." London: The *Engineer*.

"Science Abstracts," A. and B. Vol. XVIII, part 7. July 26th, 1915. London: E. & F. N. Spon. Price 1s. 6d. each.

"*Proceedings* of the New South Wales Institute of Engineers." Vol. XXXI, No. 3. July 23rd. Cardiff: The Institute. Price 5s.

**Bankruptcy Proceedings.**—HERBERT PAGE, electrical engineer, trading as "Smeeton & Page," at 63, Queen Victoria Street, E.C., and residing at 32, Marlborough Road, Chiswick.—The first meeting of creditors was held last week at the London Bankruptcy Court. Mr. Egerton S. Grey, Official Receiver, reported that the debtor had stated that he commenced business in 1891 at 63, Queen Victoria Street, E.C., in partnership with another person, who retired from the firm in 1894. The debtor continued the trading alone, but under the same style of "Smeeton & Page," and he attributed his failure to bad trade, the builders' lock-out in the early part of 1914, lack of capital, and the war. In the absence of any offer, the case was left in the hands of the Official Receiver, to be wound up in the ordinary course of bankruptcy. The public examination of the debtor is fixed for September 7th.

**For Sale.**—By order of the P.M.G., tenders are invited, up to 10 a.m., August 11th, for Plant and Machinery now at the Head P.O., Manchester. Particulars are given in our advertisement pages to-day.

## LIGHTING and POWER NOTES.

**Australia.**—The Sydney Municipal Council, in connection with the construction of the State railways, is recommended to supply Messrs. Norton Griffiths, Ltd, with electricity for purposes other than lighting at not greater than 1d. per unit, provided Messrs. Norton Griffiths, Ltd., take the whole of the electrical energy required by them in the metropolitan district of Sydney from the City Council; the arrangement, so far as the supply for the State railway is concerned, is to include the provision by the company of the necessary cables between the Council's sub-stations and the railway.

The Manilla (N.S.W.) electricity supply is now complete, and it was expected to commence the supply at the commencement of the month.

The Walgate (N.S.W.) Municipal Council has decided to submit the question of adopting an electricity supply scheme to a plebiscite of ratepayers.

The Balmoral Shire Council (Queensland) is considering the question of lighting the Shire by electricity.

The Kyneton (Victoria) Shire Council has instructed Mr. V. J. Crowley, consulting engineer, to submit a report on the proposed electric lighting of Trentham.

The Blue Mountains Shire Council has approved of the draft Bill to be submitted to the N.S.W. Parliament, empowering the Council to raise a loan of £20,000 to finance an electric lighting scheme. It is proposed to have a generating station at Wentworth Falls; for street lighting there will be installed 365 50-C.P. lamps and 11 100-C.P. lamps.—*Tenders.*

The construction of the tunnel under Sydney Harbour., between Long Nose Point, Balmoral and Greenwich, for the purpose of carrying the cables from the new power house at Whitley Bay to the North Sydney sub-station, is being seriously impeded by an inrush of water, which has risen to within 25 ft. of the surface of the shaft. The tunnel has already taken nearly two years to build about half of the length, the construction having been often impeded by the water difficulty.—*Sydney Daily Telegraph.*

**Bath.**—PRICE INCREASE.—The T.C. has decided that the charges for electricity are to be increased by 10 per cent.

**Bridge (Kent).**—The R.D.C. has consented to the Canterbury T.C. extending its mains, so as to supply current to premises at the village of Harbledown.

**Bristol.**—YEAR'S WORKING.—For the year ended March 31st last, the Corporation electricity undertaking had a total revenue of £116,626; the working expenditure was £53,574 and the gross profit £63,052. After meeting interest and loan charges the net profit was £13,594, making, with balance brought forward, a surplus of £15,909. This has been appropriated as to £3,523 largely for capital purposes; £6,011 has been placed to reserve, and £6,374 carried forward. Mr. Faraday Proctor, the city engineer, reports that 18,202,166 units were sold, an increase of 17 per cent. The revenue per unit sold has fallen below 1½d., and the total cost per unit sold to ·668d. The total connections are equal to 796,301 30-watt lamps, and include 19,542 H.P. of power connections, while applications have been received for some thousands of additional H.P. The consumers numbered 5,270, an increase of over 500 in the year.

**Bury.**—LOAN SANCTION.—The T.C. has decided to make a second application for sanction to the borrowing of £7,500 for electricity works extensions. Sanction has already been received, but in view of the war the L.G.B. has intimated that another application should be made before the money is spent.

**Canada.**—The Alberta Hydro-Electric Co., which proposes to construct a series of dams on the Bow River, within the city limits, for the production of electric power, has made an offer to supply power to Calgary at the following rates:—4,000 H.P. at $22 per H.P.; the next 1,000 H.P. at $21; the next 1,000 H.P. at $20; the next 6,000 H.P. at $19. The company asks, at the end of the five years, for a minimum of 10,000 H.P. on a renewed contract at the same prices.

In connection with the enlargement of the Montreal aqueduct and the generation of power for pumping and lighting purposes, the Board of Control has submitted an estimate of the cost of the scheme. This is put at $1,500,000, but the expenditure will not be made for a considerable time.—*Canadian Electrical News.*

**Chislehurst.**—PRICE INCREASE.—The U.D.C. has been notified by the Chislehurst Electric Supply Co. that the charges for electricity will be increased by 10 per cent. from the June quarter, this will bring the rate chargeable up to nearly 8d. per unit, which is the maximum price under the company's prov. order.—*Eltham Times.*

**Continental.**—RUSSIA.—The Petrograd T.C. has prepared a report on the purchase of the electrical concessions in the town. A scheme is to be prepared for combining the various electrical concerns that will be taken over by the town between the years 1917 and 1918; the Belgian and the "1886" electrical concerns are both differently equipped, and the exploitation of such differently equipped installations would involve the extension of the stations and the systems of all three concerns, including the existing town establishment, independently, which would mean an uneconomical expenditure of the town's money in the future. Parallel with the preparation of a project of expenditure, a technical and commercial scheme for exploitation must be formed suitable to the town's requirements. It must also be remembered that all the electrical concerns in the capital will not pass into the hands of the town at the same time; in any case, it will be necessary to proceed with the conversion and extension of the electrical installations by May, 1917. The Town Board, therefore, submits to the Town Duma that a special committee be appointed for the preparation of the various measures involved in the project suggested.

**Coventry.**—PROPOSED LOAN.—The E.L. Committee of the T.C. has recommended the Council to apply for a loan for extensions at the works, estimated to cost £91,417, subject to certain assurances from the Government. This has been agreed to by the Council. The extensions are necessary to meet the demands of firms engaged upon Government work, and the Council desires a Government guarantee against loss on capital account in the event of a cessation of the additional demand for power.

**Crayford (Kent).**—PUBLIC LIGHTING.—The P.C. has received from the West Kent Electric Supply Co. an offer to light the new estates at Barnes Cray and Northumberland Heath with 80-C.P. lamps at 65-yard intervals, at £2 2s. each per annum, on a five years' agreement, and with 100-C.P. lamps at £2 6s. each, the standards to become the property of the Council at the end of the contract term. The company is to be asked to quote for 80 and 100-C.P. lamps, at 60-yard intervals.

**Croydon.**—YEAR'S WORKING.—The report of the borough electrical engineer (Mr. A. C. Cramb) on the working of the electricity undertaking shows that the total expenditure was £43,201, a decrease on the preceding year of £2,734. The reserve and renewals funds stand at £26,870, as compared with £39,000 three years ago. The surplus on the year's working was £2,595. In the present year an increase of £10,000 to £11,000 in working expenses is anticipated, of which the increased cost of coal will account for not less than £9,000.

**Darlington.**—LOAN SANCTION.—The T.C. has received sanction to a loan of £26,000 for electricity purposes in respect of Government work; the total loan applied for was £34,000.

**Exeter.**—REFUSE DESTRUCTOR.—The T.C. has decided not to apply at present to the L.G.B. for a loan for the construction of a refuse destructor, the Board having intimated that a local inquiry would be held if desired, with a view to a loan being sanctioned when circumstances permit.

**Faversham.**—The T.C. has decided to extend the mains so as to supply current to the milling firm of Messrs. T. and T. G. Gillett.

**Fleetwood.**—The Electricity Committee has received complaints from the Electrical Contractors' Association, the Electrical Trades Union and the Fleetwood Chamber of Trade regarding the carrying out of private installation work by employés in the Council's electricity department, and has decided to take no action in the matter.

**Gillingham (Kent).**—SCHOOL LIGHTING.—The T.C. has offered to install the E.L. and supply current for lighting at the non-provided schools in the borough at 6d. per unit, this to cover the cost of current and hire of installation and fittings.

**Glasgow.**—YEAR'S WORKING.—The annual report of the electricity department shows that the gross revenue was £405,372, and the working expenditure £218,517, leaving a net revenue of £186,854. Last year's net revenue was £177,417. Interest and loan charges, &c., totalled £134,568, leaving a balance on the year's working of £52,286. After depreciation of £52,745 is written off capital account, the deficit on the year's operations is £459. Last year there was a surplus of £819. The revenue account shows an increase of income from all sources of £27,057, despite the abnormal conditions prevailing. On the other hand, the working expenses increased by £17,620, principally due, apart from the larger output, to an advance in wages to the workmen, a general overhaul of plant and mains, increased rates and taxes, and to a sum of £3,144 in allowances granted to those former employés now on service with H.M. Forces. Contracts had been entered into for the supply of coal for next year at prices very considerably in advance of those of last year. Having in view this serious addition in working cost, and increased amounts payable for interest, sinking fund, rates and taxes, and a general advance in the cost of all materials required during the coming year, the Committee has decided to recommend that rather than alter the existing scale of charges, 15 per cent. be added to all accounts from the date of last survey. The number of consumers at May 31st, 1915, was 32,030, an increase of 1,932. The quantity of electricity sold to private consumers during the past year was 85,718,795 units, an increase of 11,730,146 units.

**Godalming.**—PUBLIC LIGHTING.—The T.C. has agreed to the following offer for public lighting made by the Urban Electric Supply Co.:—Average number of units per annum to be taken as being 72,480; the average price per unit at which current is now supplied to be taken as being 2·9d.; from January 1st, 1915, to December 31st, 1915, the Council to pay for each unit supplied 2·9d.; the units actually supplied and paid for to be deducted from the 72,480 units, and on the balance (representing decrease due to restricted lighting) the Council will pay one-fourth of 2·9d. per unit, although no light is supplied.

**Greenock.**—YEAR'S WORKING.—It is reported that the electricity department has made a profit on last year's working of £10,000, which is said to be the largest in the history of the department.

**Huddersfield.**—PRICE INCREASE.—The charges for electrical energy are to be increased 12½ per cent., commencing with the next half-year's accounts.

**Leicester.**—PRICE INCREASE.—The Electricity and Tramway Committee estimates that upon this year's generating costs there will be an increased expenditure of £15,000, and recommends that from September 30th the charge for lighting be increased by ½d. per unit, and that the charge for power be increased by 20 per cent.—*Leicester Daily Post.*

NEW PLANT AND BUILDINGS.—The members of the T.C. recently inspected the new plant and buildings at the Lero power station and tramway car depôt, which have cost some £68,000. The station now contains three 1,000-H.P. and one 2,000-H.P. slow-speed 550-volt D.C. sets, which were installed in the first instance, a 1,500-H.P. motor-alternator, coupled to the Aylestone S.P. plant, a 1,500-H.P. exhaust turbine, and two recently-erected 6,000-H.P. three-phase 6,600-volt turbine sets running at 3,000 R.P.M. In connection with the latter plant there are two 2,000-H.P. rotary converters, linking it up to the 550-volt direct-current sets, while a further 1,000-H.P. rotary converter is installed at the Aylestone station, to link the latter up to the three-phase supply. Two new water-tube boilers have been installed, and a new brick chimney, 212 ft. high, has been built. The total plant capacity of the two Corporation power stations is nearly 29,000 H.P., and the output during 1914 was over 19 million units. At the car shed, the recent additions consist of repair shops.

**London.**—HAMMERSMITH.—In his report on the year's working, Mr. Bell, the Council's electrical engineer, mentions the difficulty experienced in obtaining coal by the river, the extra cartage cost being 1s. 1d. per ton, compared with 1d. per ton for transporting the coal from the Council's wharf to the generating station by the new coal handling scheme. Coal and cartage together, however, cost £90 less than in the previous year, the coal cost per unit being ·323d. as against ·334d. in 1913-14. The output sold from the Council's station, 9,523,209 units compared with 9,276,365

in the previous year, but the maximum demand was only 4,646 KW. as against 6,162 KW., this being due to not holding the Olympia Motor Show when the highest load usually occurs. The total units sold, which includes certain energy purchased by agreement, amounted to 9,717,252; the gross profit was £26,995 as against £28,629 in the previous year, and the net profit £3,718 as against £6,386 in 1913-14. The department has a reserve fund of £16,774, and in addition to normal capital repayments, has written off a further £12,343.

L.C.C.—The Finance Committee recommends the Council to sanction the borrowing of £10,188 for the extension of Poplar electricity undertaking, being £3,688 for mains and £6,500 for machinery. The Treasury imposes the usual conditions, and asks that the amounts shall be provided out of funds under the control of the B.C., without resort to other sources for the next 18 months.

Sanction is to be given to the borrowing by the St. Pancras B.C. of £15,000 for the provision of a 5,000-KW. turbo-generator, to be repaid within 15 years, on the understanding that the B.C. will agree to repay within a reduced period, equivalent to one-half the periods now unexpired, but not exceeding 15 years, the debt now outstanding on the plant and machinery, for which a term of 42 years had been granted, and which will, on the introduction of new machinery, fall within the category of stand-by or reserve plant.

The Council is also recommended to sanction the borrowing of £4,153 by the Stepney B.C. for buildings in connection with the electricity undertaking; and of £2,172 by the Woolwich B.C. for the supply of electricity to 220 houses, including wiring the houses, forming part of the Commissioner of Works' housing scheme at Eltham; also of £4,700 by the Woolwich B.C. for linking up the undertaking with the South Metropolitan Electric Light and Power Co., including £3,000 for 10,000-volt feeder cable, £1,500 for two 750-K.V.A. transformers and switchgear, and £200 for a sub-station.

The Finance Committee, reporting on the application of the Battersea and Fulham B.C.'s for sanction to the borrowing of £5,814 and £8,376, in connection with the scheme for linking up the electricity undertakings of Battersea and Fulham and Hammersmith, says that the Treasury raises no objection to the loan in the case of Battersea as the expenditure is urgently necessary. The Committee is advised that the only work which complies with the Treasury requirement is that relating to the linking up of the Battersea and Fulham stations, and recommends that for the present sanction shall be limited to the cost of this work, viz., Fulham, half the cost of the main, £2,618, and transformer, £1,850; Battersea, half the cost of the main, £2,618. This is subject to the B. of T. approval of the agreement.

**Mansfield.**—PROPOSED LOAN.—The T.C. has applied to the L.G.B. for a loan of £500 for electric services. A new five years' agreement for the supply of current has been entered into with the Tramway Co.

**Market Weighton.**—E.L. SCHEME.—The East Riding of Yorks C.C. has consented to a company being formed to supply electricity to the town, and the laying of underground cables along the main roads in the district.

**North Wales.**—The North Wales Power and Traction Co., Ltd., has applied to the B. of T. for permission to erect 20,000-volt overhead lines from the sub-station at Gelli Ffrydian, Nantile, to Trevor Quarry.

**Norwich.**—YEAR'S WORKING.—The report of the Electricity Committee on the year's working of the electricity undertaking shows gross receipts amounting to £57,261, and working expenses to £31,010, leaving a gross balance of £26,250 to be carried to net revenue. The charges for interest and sinking fund amounted to £18,237, and the balance carried to appropriation account was £8,013. The gross receipts for the previous year were £58,764, and the balance £27.831. Out of the balance of £8,013 a sum of £4,055 has been expended in completion of the scheme commenced three years ago, and the balance of £3,957 will be carried forward. For the first time in the history of the undertaking the output shows a decrease due to the restricted public lighting; the public electric lamps number 2,639. Due to more efficient working £706 was saved in coal cost, although a higher price was paid, and it is not proposed to raise prices to consumers.—*Eastern Daily Press.*

**Nuneaton.**—STREET LIGHTING.—The Electricity Committee has decided to take over the existing gas lamp standards, which would be dispensed with when electric light was substituted for gas, at 17s. 6d. per standard.

**Southampton.**—PRICE INCREASE.—It is proposed to generally increase the price of electricity, by from ½d. to ¼d. per unit in most cases, for lighting and heating. A simpler scale of charges for power supply is proposed to be substituted for the present rates; the prices for public lighting and tramway supply are to remain unaltered.

**South Africa.**—The supply from the Cape Town electricity works recently suffered a brief interruption, the cause of which is supposed to have been an attempt by some person to cut an 11,000-volt cable supplying the southern suburbs. As the cable was alive at the time it is considered remarkable that the person in question was not killed, and efforts are being made to trace him.

**Southend-on-Sea.**—SEWAGE PUMPING.—The T.C. has consented to a distributor and branch main being laid, at a cost of £201, to the sewage pumping stations in the town.

**Stoke-on-Trent.**—WIRING CONTRACTS.—In a report to the T.C., the Electricity Supply Committee states "That this Committee cannot recommend any particular firm of contractors, and that it be an instruction to the engineer that when information respecting wiring contractors is asked for by consumers, a list giving all the contractors in the district be supplied."

**Trowbridge.**—The Electric Supply Co. has applied to the U.D.C. for permission to use overhead lines in order to supply current to the Isolation Hospital in Bradley Road.

**Warrington.**—PRICE INCREASE.—The price of current for lighting purposes and for tramways is to be increased as from August 1st by 10 per cent., and for heating and power purposes (except in cases where the price is regulated by a coal clause) by 15 per cent.

**West Bromwich.**—The Electricity Committee proposes to supply Messrs. J. B. & S. Lees, subject to agreement, for a period of five years.

**Wirral.**—PROV. ORDER.—The U.D.C. has decided to oppose an application, which is to be made to the B. of T. by Messrs. Johnson & Phillips, for a prov. order empowering them to supply electricity for lighting purposes within the district and to apply for a further order to make an electric tramway for passengers and goods.

**Worksop.**—PRICE INCREASE.—Owing to the war's effect on the undertaking, the U.D.C. has decided to increase the price of current by ½d. per unit for lighting, and by ¼d. per unit for power, from the end of the present quarter.

**York.**—LOAN SANCTION.—The L.G.B. in forwarding to the T.C. sanction of loans of £7,047 for mains; £1,286 for poles, &c., for overhead cables; £4,491 for rotary converters, &c.; £830 for static transformers; £1,626 for services; and £656 for buildings, intimates that it views with great dissatisfaction the action of the Council in incurring expenditure in anticipation of sanction, and again warns the Council to avoid such irregular procedure in future.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—YEAR'S WORKING.—The annual report on the working of the Corporation tramways for the last year shows that the cars ran 1,909,009 miles, and carried 24,048,816 passengers, producing a revenue of £88,002. The working expenses were £51,525. The net balance was £26,509, and the profit £11,000, of which, for the first time, one-third will be available for application to the common good, to the reduction of the rates, or towards public improvements. The receipts, the manager points out, are still showing a regular increase. An agreement has been entered into with the electricity department for a period of five years for a supply of energy at the rate of '85d. per unit for the first two million and '80d. for any quantity beyond, in one year.

**Blackpool.**—The receipts for the Corporation tramways for the last month were £7,035, a decrease of £3,651 compared with the same period last year. The total receipts from April 1st to July 15th were £21,232, a decrease of £7,126, and the passengers showed a reduction of 935,197.

**Bury.**—The B. of T. has approved of the Limefield and Jericho tramways extensions.

**Canada.**—In connection with the Hudson Bay Railway scheme, attention is being directed to the water powers of the Nelson and Grass rivers, both in the vicinity of the railway. The accessible water power of the Nelson river is estimated at 6,000,000 H.P., and of the Grass river at one quarter of that amount.

**Castleford.**—The U.D.C. has decided to invite the B. of T. to inspect the tramlines in Pontefract Road, the condition of which is alleged to be unsatisfactory.

**Continental.**—ITALY.—The Società Tramvie Elettriche, recently formed for the construction of an electric tramway between S. Angelo, Mirandola Terme, and Chignolo Po, has entered into negotiations with the Commune of S. Angelo with a view to the extension of the original scheme, in the direction of Milan. The society stipulates that the commune shall bear an adequate share of the expenses, both of the construction and of the study of the new line. The gauge of the tramway line is to be the same as that of the State railways, and goods stations are to be constructed.

A concession has been secured for the construction of an electric tramway between Valle della Versa and Stradella, whence an eventual continuation will link up with Pavia by traversing the new bridge at Becca. The line has a length of 10 km., and its cost is estimated at 918,284 lire for the permanent way, overhead installation, &c., and about 189,000 lire for rolling stock.—*Revista Tecnica d'Elettricità.*

SWITZERLAND.—The progress of railway electrification in Switzerland is shown by the fact that there are some 3,000 km. of line converted from steam to electric working, the energy being supplied by local water-power. The first section electrified was that of the St. Gothard tunnel, of a length of 108 km. Single-

phase current is supplied at 60,000 volts pressure to various substations, whence it is stepped down for distribution.

SPAIN.—It is proposed to construct a narrow-gauge electric railway, with double track, from Fonsagrada to Ribadeo. The line will pass through the valleys of Langreo and Santa Eulalia, and terminate in the basin of the River Eo. The concession for the line has been secured by the Sociedad Hispano-Belga de Ferrocariles, Mineria e Industria.—*Industria e Invenciones.*

**Croydon.**—YEAR'S WORKING.—The report of the Corporation tramways for the year ended March 31st, 1915, shows that the total revenue amounted to £88,614; working expenses were £70,307, and £1,974 was absorbed in war allowances to employés, leaving a credit balance of £16,332. From this £7,889 was deducted for interest, £7,414 for sinking fund and £1,586 for income-tax, and the net balance of £191 was placed to the renewals fund. The reserve and renewals fund stands at £41,643. Compared with the preceding year the traffic receipts increased by £2,907, and it was stated that but for the war a net profit of £5,000 could reasonably have been expected. Already the increase in receipts for the present year was over £700. However, owing to the increasing cost of coal there would be an extra £3,000 to find this year for current.

**Exeter.**—The B. of T. has informed the T.C. that it is not at the present time prepared to sanction the proposed tramway track alterations on the Blackboy Road route.

**Formby.**—RAILWAY EXTENSION.—An inquiry was held last week by the Light Railway Commissioners into the proposal to run a line to Formby headland, by an additional loop connecting with the existing electric line of the L. and Y. Rly. Co., running between Liverpool and Southport. The total length will be seven miles, and the cost £62,650.—*Manchester Guardian.*

**Glasgow.**—FEMALE LABOUR.—The Tramways Committee has had some difficulty in the selection of uniforms for the large number of women conductors now employed. The problem has now been solved and contracts have been placed for a supply of Black Watch tartan skirts (large black and green check) and green straw hats with medium brims, which will, it is thought, harmonise comfortably with the regulation green uniform of the department.

**Halifax.**—YEAR'S WORKING.—The total revenue from the Corporation tramways for year ended March 31st was £113,170; the working expenses amounted to £73,504; interest on capital to £10,424; contribution to sinking fund, to £12,106; and the net profit to £16 211. In the previous year the net profit was £13,643, and in 1912-3, £12,681.

**Leicester.**—For the Corporation tramways the expenses for the current year are estimated at £30,000 more than in 1914, due to war allowances, bonus, interest and sinking fund, and extra generating costs. After deducting the estimated receipts, it is not improbable there may be a net deficiency of £19,000, to meet which the Committee recommends the increase of fares on certain sections of the system.—*Leicester Daily Post.*

**London.**—L.C.C.—The Highways Committee recommends that grants, estimated at £1,189, be made to certain officers and employés in the tramway department for special services in connection with the recent strike.

The Highways Committee also recommends that the services of Messrs. Kennedy & Donkin, consulting engineers, whose agreement expired on May 31st, 1915, be retained for a further period of one year, and thereafter, subject to three months' notice, to advise and report as to the extension of the Greenwich generating station, and to afford the Council whatever consultative assistance may be required.

The same Committee also recommends that the President of the L.G.B. be informed that, with a view to avoiding the waste in men, materials and money, due to unnecessary transit services in London, the Council is prepared to participate in a conference to be held under the chairmanship of a representative of his department, with the representatives of other traffic authorities and undertakings; and that the Highways Committee be authorised to take all necessary steps in connection with matters arising out of such conference, provided that any arrangement come to be limited to the period of the duration of the war.

HACKNEY.—In view of the delay in the reconstruction of the existing tramways in Lauriston Road and Church Crescent, caused by the Treasury restrictions on borrowing, the L.C.C. has decided to remove the rails and repair the paving where necessary. If this is done it will prevent the Council from periodically running a horsed car over the route as required in order to retain its powers over the tramways; the L.C.C. has asked the B. of T., under the circumstances, to give an assurance that no order under Sec. 41 of the Tramways Act, 1870, declaring the powers of the County Council in respect of the tramways to be at an end, shall be made while the Council is prevented by H.M. Treasury from obtaining a loan for the purpose of reconstruction, and the B.C. has been asked to support the Council's application.

**Newcastle-on-Tyne.**—YEAR'S WORKING.—The annual report on the Corporation tramway undertaking shows total traffic receipts of £281,851, an increase of £30,837 on the preceding year. The income from parcels totalled £1,704, advertising £3,018, and from lighting £7,719, making, with other items, a gross revenue of £293,263, an increase of £32,062. The total working expenditure was £160,457, compared with £147,552, an increase of £12,905, due to £3,970 increased cost of general repairs and maintenance, and £7,437 increase in traffic expenses caused by the concessions granted to the employés in August, but does not include £4,364 paid to dependents of men on active service. Interest charges amounted to £29,574, and £5,411 was paid in income-tax; sinking fund charges were £43,355; £18,000 was allocated to relief of rates; £6,236 for motor-'buses, and other items make a total expenditure of £73,700, leaving £24,822 to be carried to the reserve and renewals fund. At the beginning of the year the reserve and renewals fund stood at £94,337; out of this had been expended £44,505; after adding the present balance the fund stands at £74,655, a decrease on the year of £19,682.

**Swansea.**—TRAMWAY EXTENSIONS.—The Light Railway Commissioners have granted an order authorising the construction of additional tramways in the borough.

**Tottenham.**—RAILLESS TRACTION.—The Metropolitan Electric Tramways, Ltd., has informed the U.D.C. of its intention to promote in the next Session of Parliament a Bill to revive the powers under its Railless Traction Act, of 1913.

## TELEGRAPH and TELEPHONE NOTES.

**British Cable Ship Lost.**—The British cable ship *Strathcona*, from Auckland, has been lost in the South Pacific, near the Fiji Islands. The cable-layer *Iris* sent a wireless message, received at Suva on July 14th, to the effect that she was searching for the survivors, and had found one boat-load. A second boat, believed to be making for Tongatabu, is unaccounted for.

**Secret Wireless.**—The German authorities at Brussels offer £500 reward to anybody who will inform them who is the owner of a mysterious wireless station which is known to be working at some private house in Brussels. For nine months the Germans have searched in vain for the apparatus, which is known to have revealed to people in Brussels important war news.

**Swedish Wireless Station.**—A Committee has been formed for the erection of a wireless station at Karlsborg, Sweden, for direct communication between Sweden and America, thus escaping the British censorship. The Chairman of the Committee is the general manager of the Swedish State Telegraph Co.

**Throat Telephones.**—At the Panama Exhibition in San Francisco demonstrations are given daily in the Mines Section of telephone communication between the advance or rescue party and the outside of the mine, in the case of mine accidents. The United States Bureau of Mines rescue crew conducts the proceedings. Each member of the rescue party wears strapped to his throat a small, specially designed transmitter and a watchcase receiver strapped to his ear. The reason for this special equipment is that a man, wearing any of the different types of oxygen helmets which cover his mouth, cannot use the ordinary type of telephone transmitter. The throat transmitter transmits speech practically as well as the standard type of telephone instrument; it is very small and light, and is provided with a soft rubber cup which assists in holding it firmly against the throat.—*Fire.*

**United States.**—On July 8th the U.S. Government took possession of the Sayville radio-station of the Atlantic Communication Co. in the interest of American neutrality, and to avoid contravention of the Hague Convention forbidding the establishment of a wireless station on neutral soil during a war, as already reported.

Coincidentally with the taking-over of the station by the Government, it was announced that the rate of $1.00 per word to Germany would be reduced one-half and the $1.08 rate to Austria-Hungary to 58 cents a word, plus the land rate in both instances. The Postal Telegraph Cable Co. has been handling the work at the Sayville station. In order to maintain its legal rights, the Atlantic Communication Co. will file a formal protest against the action of the Government.—*T. and T. Age.*

**Japan.**—Wireless communication has been established between Honolulu and Japan, a distance of 3,400 miles.—*T. and T. Age.*

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—ADELAIDE.—August 25th. Dry cells, earth clips, recording counters, and various other instruments and apparatus, for the P.M.G. See "Official Notices" July 9th.

September 1st. Condensers, testing sets, rheostats, Morse sounders, and Wheatstone transmitters for the P.M.G. See "Official Notices" July 23rd.

PERTH.—August 25th. P.M.G. One ton of crushed salammoniac, and 1½ tons of steel galvanised wire. See "Official Notices" July 23rd.

August 25th. Common-battery telephones, for the P.M.G. See "Official Notices" to-day.

September 29th. Telephone switchboard parts, for the P.M.G. See "Official Notices" to-day.

SYDNEY.—September 13th. Council. A.C. and D.C. electric motors. Specification (10s. 6d.) from E.L. Department, Town Hall.*

September 6th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at Richmond pumping station.* Acting Secretary, 341, Pitt Street, Sydney.

MELBOURNE.—August 17th. Electric lamps, caps and sockets, telephone instrument parts, for the P.M.G.*

August 24th. Telephone instruments for the P.M.G.*

August 31st. Switchboard parts for the P.M.G.*

**Bristol.**—August 23rd. Corporation. One 6,000-KW. three-phase steam turbo-alternator with condensing plant. See "Official Notices" July 23rd.

**Darlington.**—August 4th. Additions to boiler house, electric power station, for the T.C. Mr. Geo. Winter, Borough Surveyor (returnable deposit of £2 2s.).

July 31st. Corporation. Three or five-ton lorry (petrol, electric, or steam), with end-tipping body. Borough Surveyor.

**Middleton.**—August 10th. Corporation. Coal for the electricity works. Particulars from Mr. S. Pauls, Electrical Engineer.

**New Zealand.**—WELLINGTON.—August 11th. 1,500 red and 2,000 white three-conductor cords, 3 tons of bichromate of potash for the Public Service Stores Tender Board.*

**Rochdale.**—August 4th. Twelve months' supply of paper-insulated cables, for the Electricity Committee. Specifications (£2 2s.) from C. C. Atchison, Engineer and Manager, Dane Street.

**Sheffield.**—July 30th. Water service conduit screen chamber, penstocks, valves, piping, &c., for the Electric Supply Committee. Mr. S. E. Fedden, General Manager and Engineer.

**South Africa.**—JOHANNESBURG.—August 25th. 8,600 drawn-wire spiral filament traction lamps, spare parts for tramcars, for the Municipal Council.*

September 25th. For the T.C. Two turbo-alternator sets, condensing plant, switchgear, &c. Specification, &c., on deposit of £2 2s., from Mr. J. H. Dobson, General Manager.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

## CLOSED.

**Barrow.**—The T.C. has accepted the following tenders in connection with an induced-draught plant:—

Chimney.—John Thompson, Ltd., £340.
Fan.—Davidson & Co., £205.
Motor.—British Thomson-Houston Co., Ltd., £234.
Ash hopper.—Herbert Morris, Ltd., £289, exclusive of the hopper.

**Bristol.**—The Electrical Committee of the City Council has entered into the following contracts:—

City Foundry Co.—Boiler and furnace castings, £233.
Sykes & Sugden, Ltd.—Joint and junction boxes, £508.
British Westinghouse Co., Ltd.—Alternating-current meters, £1,329.
W. Lucy & Co., Ltd.—Fuse boxes, £148.
Ferranti, Ltd.—Direct-current meters, £965.
Oliver Arc Lamp, Ltd.—Arc lamp carbons, £765.

**Coniston.**—The new Electric Supply Co., Ltd., has accepted the following tenders in connection with the undertaking:

J. Bell.—Buildings.
J. Usher.—Pipe track.
J. Gordon & Co.—Turbines and water plant.

**Glasgow.**—The Tramways Committee recommends acceptance of offers for special track work from the Lorain Steel Co. and Messrs. Edgar Allen & Co.

**Holyhead.**—The U.D.C. has accepted the tender of Geo. Watkinson & Sons, Ltd., for 500 tons of coal for the electricity works during a year, at £1 1s. 6d. per ton for through and through, and £1 5s. per ton for screened steam.

**Leith.**—Messrs. Siemens Bros. have secured the contract for the supply of Tantalum traction lamps to the B.C. for the ensuing 12 months.

**London.**—BATTERSEA.—The B.C. is recommended to accept the tender of Messrs. E. Green & Sons, Ltd., for renewal of parts of No. 2 economiser at the electricity station, at £512.

L.C.C.—The Highways Committee recommends that the chairman and vice-chairman of the Committee be severally authorised during the summer recess of 1915 to open any tenders that may be received for the provision of switchgear in connection with the reserve supply of electrical energy for working the Council's tramways.

**Nuneaton.**—The T.C. has accepted the following tenders for the Electricity Department:—

Nuneaton Engineering Co., Ltd.—House-service joint boxes, without wood plugs, large size, 5s. 9d. each; small size, 4s. 9d. each.
C. M. Ayres & Co.—Wood plugs for house-service boxes, £1 1s., £1 2s. 6d., £1 3s. and £1 4s. per gross.

**Oswaldtwistle.**—The D.C. has accepted the following tenders:—

For lighting the new Free Library.—Messrs. Bland Light Syndicate.
For the repairs to the fire brigade electric bells.—Messrs. W. Rothwell and Sons, Great Harwood.

**Rochford (Essex).**—The B. of G. has accepted the tender of Mr. R. B. Emerson, of Ashburnham Road, Southend-on-Sea, for the installation of electric bells at the Workhouse, at £13.

**Worcester.**—The T.C. has decided to purchase from the Erith Engineering Co., a four-retort stoker for the electricity works, at £350, to be paid for at the conclusion of the war.

## FORTHCOMING EVENTS.

**North of England Institute of Mining and Mechanical Engineers.**—Saturday, August 7th. At 2 p.m. At Newcastle-on-Tyne. Annual meeting.

## NOTES.

**"Overhead Costs."**—American articles often contain references to "overhead costs," the significance of which can only be guessed at by English readers. According to Halbert P. Gillette, in the *Electrical World*, several recent decisions of public utility commissions serve to call attention to a rather general lack of knowledge about overhead costs in the United States also. The term overhead costs has no generally accepted meaning, but appraisal engineers usually, although by no means universally, limit the items of construction "overhead costs" to the following:—(1) Engineering and inspection; (2) supervision (other than gang foremen and the profits of contractors); (3) organisation (preliminary to construction); (4) administration, accounting and clerical; (5) legal; (6) insurance (casualty, fire and title); (7) taxes; (8) interest; (9) contingencies, omissions and waste; (10) brokers' fees; (11) promoter's profit.

**Diesel Engine Users' Association.**—The July meeting was held at the Town Hall, Kingston-upon-Thames. The Mayor, Mr. C. H Burge, attended at the opening of the meeting and addressed the members, referring to the work which was being carried out by the Association, and to the very satisfactory results which had been obtained from the working of the Diesel engine plant at the electricity works of the Corporation.

The question of a suitable allowance for depreciation of Diesel-engine plant in connection with income-tax assessment was then further considered, and, after some discussion, the following resolution was unanimously passed:—"That, in the opinion of this Association, the present allowance made for depreciation by wear and tear on Diesel-engine plant by the Inland Revenue authorities is inadequate, and that an allowance at the rate of at least 15 per cent. per annum should be claimed."

The members of the Association were subsequently entertained at tea by the Mayor and Mayoress, and a visit was paid to the electricity station, where the Diesel engines were seen at work. The next meeting will be held in October. Information concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, 19, Cadogan Gardens, London, S.W.

**A Tidal Voltage.**—Troubled because his lamps grew dim for a few hours each day, and then as curiously regained their brilliancy, a customer recently called on the Boston Edison Co. to ascertain the cause. When the company's investigator visited the premises the voltage was normal, and no perceptible ground could be detected on the circuit. Before long, however, the phenomenon of the previous days repeated itself. The pressure dropped quite rapidly from 110 volts to 60 volts, and remained at that value for several hours, soon rising again, however, in the same mysterious manner. As there were no motors in the vicinity which could cause the drop in pressure, it was decided to connect a recording voltmeter to the line. After this had been left in circuit a few days, the charts revealed the fact that each day the voltage started to fall about 50 minutes later than on the preceding day. As the consumer's property was situated on a wharf, it at once occurred to the inspector that the rise and fall of the tide might in some way be the cause of the trouble. This was subsequently found to be the case, the rise of the salt water having short-circuited the service wires.—*Electrical World.*

**Board of Inventions.**—The Admiralty announces that the address of the Board of Inventions and Research is Victory House, Cockspur Street.

**Engineering Standards Committee.**—The first annual meeting, since its reorganisation, of the Sectional Electrical Committee of which Sir John Snell is the chairman, was recently held to approve such work as was completed during the session, and to receive the reports of the work in progress.

As a result of this meeting, it is understood that the following Reports, which have been transmitted to the Main Standards Committee for ratification, will shortly be available to the public :—

1. British Standardisation Rules for Electrical Machinery.
2. British Standard Specification for Electricity Meters.
3. British Standard Specification for Charging Plug and Socket for Vehicles propelled by electric secondary batteries.
4. British Standard Specification for Wall Plugs and Sockets, 5-ampere, 2-pin without earthing device.

As to the progress of the work in hand, it may briefly be stated that the Sub-Committee on Electric Power Cables, of which Mr. C. P. Sparks is the chairman, has under consideration the revision of the Report on Copper Conductors (Report No. 7, revised March, 1910). The Sub-Committee on Electric Lamps will, in co-operation with the Tungsten Lamp Association, in the early autumn, consider the drafting of a Standard Specification for Tungsten Lamps, and the question of Miners' Electric Lamps will also engage the attention of this Sub-Committee.

The Sub-Committee on Electrical Accessories, of which Mr. C. H. Wordingham is chairman, has several Panels at work, and it is hoped that recommendations will soon be forthcoming in regard to Motor-starters, Heating and Cooking Apparatus, and Fuses, as well as other electrical fittings.

A Panel has also been formed to revise the Standard Specification for Ammeters and Voltmeters (Report No. 49, issued in September, 1909), and on this Panel the British Electrical and Allied Manufacturers' Association will be represented by Mr. E. B. Vignoles and Mr. Patrick Hamilton.

Lastly, the Sub-Committee on Electrical Symbols, presided over by Dr. A. Russell, has appointed two Panels, one to draw up a British List of Graphical Symbols for use in installation and power work, and the other to deal with Telegraphs and Wireless Symbols.

The extremely important question of standards for distributing pressures for new systems, which has been brought forward by Mr. C. H. Merz, is to occupy the attention of a Sub-Committee, under the chairmanship of Dr. R. T. Glazebrook, C.B., upon which all interests will be represented.

As a rough gauge of the activities of the Committee, it is noted that during the past year more than 90 meetings have been held, and from the above record of work accomplished and in hand, it will be appreciated that the Electrical Section of the Committee is engaged on work of the highest importance to the industry at large.

**Fatality.**—ELECTRIC 'BUS ACCIDENT.—On Thursday afternoon last, a Coroner's inquest was held on Francis W. Dinsdale, who died from injuries received at the York electricity works through being accidentally crushed between an electric 'bus and a wall. From the evidence, it appears that a motorman named Thompson went to the garage on the previous Tuesday morning for the purpose of taking an electric 'bus out for service; the 'bus battery had been charged during the night, and, according to the driver who had the 'bus on the previous evening, the controller was left in the neutral position as required for charging, and the brakes were on. Thompson, while talking to the deceased, who was standing in front of the 'bus, inserted his key into the safety switch, which was in the "off" position, and drew it over for running, when the 'bus jumped forward, pinning Dinsdale against the wall. Thompson immediately jumped on to the platform, and, according to his statement, discovered that the controller was in the forward position, instead of the neutral position, as he had anticipated; he promptly reversed the controller and released the brakes, when the 'bus moved sufficiently to allow Dinsdale to be released. Thompson said the brake was on so hard that it broke the driving shaft when he switched in; he admitted that had he looked he might have seen that the controller was not in the neutral position; when he pulled the controller off the "4 or 5 notches," he put it on to No. 2 reverse, but the shaft was broken, and it would not act; he did not know how the 'bus came back. The Coroner, in summing up, pointed out that there was no evidence to show who had moved the controller, but there was a possibility of its being accidentally moved; he thought the driver should verify the position of the controller. A verdict of "Accidental death" was returned.

**Electrical Rain-Making.**—A correspondent of the Sydney *Sun* says that Mr. J. G. Balsillie, wireless expert of the Commonwealth, believes that he can command rain by a novel invention which will have much the same effect on the clouds as a series of mountain peaks. He is about to begin experiments, which, if successful, will prove revolutionary. Large scale experiments, with the object of causing artificial rain, are to be made at the cost of the New South Wales Government. For four years Mr. Balsillie has been conducting research work with the idea of discovering means of artificially causing rain. He proposes to create at a high altitude a discharge centre of electricity. For this purpose he will draw from a suitable generating plant a supply of current which will be discharged in two forms at a very high potential from a balloon anchored at a height of from 6,000 to 7,000 ft.

To Australia the question of rainfall is of the utmost importance, and any means which will ensure an increase of the rainfall must be of untold benefit. Mr. Balsillie believes that if all the clouds which pass over Australia can be made to discharge their moisture while over the land, the rainfall can not only be increased, but regulated.

Experiments made by him have led him to believe that ionisation through the ultra-violet rays of the sun does not exist in the atmosphere generally any closer to the earth's surface than within 50,000 ft. In the absence of this ionisation the moisture-bearing clouds do not contain the necessary nuclei on which the moisture can condense. If there are no nuclei there can be no condensation.

His problem has been how to provide these required nuclei, and, further, how to electrify the minute drops of moisture in the cloud so that mutual attraction may be set up among them. Assuming this to be done, the result must be that the minute drops of moisture coalesce on the nuclei, and continue growing in volume until gravitation draws them down to the earth.

Mr. Balsillie's suggestion for carrying out experiments on a large scale, to prove his laboratory work, was received with scepticism. However, in Mr. W. A. Holman, Premier for New South Wales, Mr. Balsillie found a sympathetic listener. Mr. Holman, appreciating the immense possibilities of Mr. Balsillie's idea, appointed a Scientific Committee to report on the Balsillie device, and advise the Premier regarding its scientific basis. This Committee had a five hours' discussion with Mr. Balsillie, and unanimously decided to investigate his device. It is anticipated that nothing like a complete knowledge of the new art of rain-making will be gained until the field experiments have been conducted over a long period.

Mr. Balsillie believes that it will be possible, by having a number of stations erected on the lines of the prevailing winds, to secure from all the clouds that come inland the whole of the moisture they contain. One result that he anticipates will follow the establishment of these rain-making stations is that natural thunderstorms and lightning will cease.

**Nickel-Chromium Alloy.**—The Marsh patent, covering the use of an alloy of nickel and chromium for electrical heating elements, has been the subject of an action at law in the United States Courts at the instance of the owners of the patent (No. 811,859, 1906), the Hoskins Manufacturing Co., who alleged that the "calorite" alloy of the General Electric Co., U.S.A., was an infringement. A District Court supported this contention, and the U.S. Circuit Court of Appeals has confirmed the decision of the District Court. It was shown that the General Electric Co. sought to purchase the patent, and failing in this, produced an alloy containing nickel 65 per cent., iron 15 per cent., chromium 12 per cent., and manganese 8 per cent., which they called "calorite." It was stated that this alloy possessed the same properties of high resistivity and durability as the patented alloy, and answered the same purposes. The Court regarded the additions of iron and manganese as "small and inconsequential ingredients," and decided that the alloys were essentially identical.

In the course of the action the English patent of Placet (No. 202, 1896), was cited as an anticipation, that inventor having pointed out the valuable properties conferred upon alloys by the use of chromium, including high electrical resistance and durability at high temperatures. He had not, however, applied the alloy to electrical heating, and Marsh, the patentee of nickel-chromium for this purpose, while disclaiming invention of the alloy, claimed the discovery of a new use for it as the basis of his patent, which was accepted by the Court.

**Magnetos for Ignition Purposes.**—A practical step to find a remedy for the preponderating German participation in the French home trade in magnetos for motor-cars has been taken by our contemporary, *La Revue Electrique*. It has invited the contribution of an article by a specialist in this department, Mons. H. Armagnat, which appears in the June issue of that journal. The writer has not only given a succinct historical account of his subject, but shows that the Germans, far from being inventors in this department, are merely patentees of points of detail, the credit of invention belonging mainly to Frenchmen. The author develops a complete theory of these apparatus, supported by experimental data, and sets out the paths which should be followed to perfect the ignition magneto.

**Institution and Lecture Notes.—South African Institute of Electrical Engineers.**—The Council has formed a Committee called the Safety Precautions Committee, with the object of bringing together and assimilating data towards the elimination of risk and electrical accidents.

Mr. Harold Wragg recently read a paper on "Water-Power Plants; with Special Reference to the Power Plants of the Rezende Mines, Ltd., Penhalonga, Southern Rhodesia."

**Canadian Electrical Association.**—The Executive Committee decided to dispense with the usual annual Convention, being unwilling to ask the members of the Association to incur any unnecessary expense at this time. In place of the Convention, the Committee called a one-day meeting of representatives of operating companies, which was held in Ottawa on June 26th.

**Educational.**—CITY AND GUILDS OF LONDON INSTITUTE.—The Council of the Institute has awarded diplomas of "Associate" to the following students who completed a full course of instruction in electrical engineering at the close of the recent session :—

City and Guilds (Eng.) College: B. Hague (Siemens Memorial and Henrici Medals), S. W. Messent, C. Jacovou, C. G. Shaw, H. C. Gibson, W. H. Cable, D. Jacovou, F. F. H. Schroeder.

City and Guilds Technical College, Finsbury: W. J. Jones.

**Wireless High-Power Stations.**—A correspondent of the *Financial Times* supplies an interesting explanation of the Government's decision not to proceed further, in view of the war, with the chain of Imperial wireless stations decided upon some time ago, but to compensate the company for its outlay in connection with this matter, and adopt an alternative project more in keeping with the circumstances which have arisen since the commencement of the European crisis. The Government at the outbreak of the war took the view, which has since been justified by events, that in all likelihood we should be able to capture the high-power "wireless" stations already erected by Germany, thereby rendering unnecessary some at least of the stations which were to have been constructed as part of our original project. In addition, the Colonial Empire built up by Germany, but now the property of the Allies, will be divided among them under a friendly arrangement, and it follows that the possessions of Great Britain will be substantially added to. It will, therefore, be convenient to erect certain stations not originally contemplated on sites alternative to those fixed upon at the outset, provided that there is no installation near by of German origin, for in that case the enemy installation would be used instead. Thus we arrive at the dual proposition of a less ambitious financial scheme, and also one offering many points of distinction as regards geographical distribution. In the Pacific we are now in a position to establish stations on various islands not previously in our possession, which will add very much to the efficacy of the entirely wireless system. Finally, whereas previously precautions had to be taken against the rival system adopted by the German Government, there is little danger now of any trouble on this score, and, while Mr. Isaacs rightly claimed on Monday last that the Marconi method of wireless telegraphy has been of immense service and assistance to the Government during the crisis of the past 12 months, the war has probably done not a little to render the Marconi patents governing wireless telegraphy the most valuable in the world, owing to the fact that the British authorities are able to give full scope for their development, which no other nation can do on the same scale, if only for the reason that there is no other Colonial Empire equal in size to our own.

**Scientific and Industrial Research.**—The scheme outlined by Mr. J. A. Pease in May has now taken shape; the *Times* states that particulars were issued on Monday by the Board of Education in a document signed by Mr. Arthur Henderson. The scheme is designed to establish a permanent organisation, and it is pointed out that the research done should be for the kingdom as a whole, and that there should be complete liberty to utilise the most effective institutions and investigators available, irrespective of their location in England, Wales, Scotland, or Ireland. There must, therefore, be a single fund for the assistance of research under a single responsible body.

The scheme provides for the establishment of :—

(*a*) A Committee of the Privy Council responsible for the expenditure of any new moneys provided by Parliament for scientific and industrial research.

(*b*) A small Advisory Council responsible to the Committee of Council and composed mainly of eminent scientific men and men actually engaged in industries dependent upon scientific research.

The Committee of Council will consist of the Lord President, the Chancellor of the Exchequer, the Secretary for Scotland, the President of the Board of Trade, the President of the Board of Education (who will be Vice-President of the Committee), the Chief Secretary for Ireland, together with such other Ministers and individual members of the Council as it may be thought desirable to add.

The first non-official members of the Committee will be :—The Right Hon. Viscount Haldane of Cloan, the Right Hon. Arthur H. D. Acland, and the Right Hon. Joseph A. Pease, M.P.

The first members of the Council will be :—The Right Hon. Lord Rayleigh, Mr. G. T. Beilby, Mr. W. Duddell, Prof. B. Hopkinson, Prof. J. A. M'Clelland, Prof. R. Meldola, and Mr. R. Threlfall, with Sir William S. M'Cormick as administrative chairman.

It is in no way intended that the scheme should replace or interfere with the arrangements which have been or may be made by the War Office or Admiralty or Ministry of Munitions to obtain scientific advice and investigation in connection with the provision of munitions of war.

A great part of all research will necessarily be done in universities and colleges which are already aided by the State, and the supply and training of a sufficient number of young persons competent to undertake research can only be secured through the public system of education.

The primary functions of the Advisory Council will be to advise the Committee of Council on—

1. Proposals for instituting specific researches.
2. Proposals for establishing or developing special institutions or departments of existing institutions for the scientific study of problems affecting particular industries and trades.
3. The establishment and award of Research Studentships and Fellowships.

The Advisory Council will also be available, if requested, to advise the several Education Departments as to the steps which should be taken for increasing the supply of workers competent to undertake scientific research.

Arrangements will be made by which the Council will keep in close touch with all Government Departments concerned with or interested in scientific research, and by which the Council will have regard to the research work which is being done or may be done by the National Physical Laboratory.

It is essential that the Advisory Council should act in intimate co-operation with the Royal Society and the existing scientific or professional Associations, Societies, and Institutes, as well as with the universities, technical institutions, and other institutions in which research is or can be efficiently conducted.

It is proposed to ask the Royal Society and the principal scientific and professional Associations, Societies, and Institutes to undertake the function of initiating proposals for the consideration of the Advisory Council, and a regular procedure for inviting and collecting proposals will be established. The Advisory Council will also be at liberty to receive proposals from individuals and itself to initiate proposals. It is contemplated that the Advisory Council will work largely through sub-committees reinforced by suitable experts in the particular branch of science of industry concerned. On these sub-committees it would be desirable, as far as possible, to enlist the services of persons actually engaged in scientific trades and manufactures dependent on science.

Office accommodation and staff will be provided for the Committee and Council by the Board of Education.

**Appointments Vacant.**—Shift engineer for duration of war, for Malvern U.D.C.; gentleman to attend to export matters under direction of the secretary, required by the B.E.A.M.A.; mains foreman (£2 10s.), for Newport Corporation; circuit designer and draughtsman (£350), for Victorian State Railways. Particulars are given in our advertisement pages.

**Electric Vehicle Co.'s Amalgamation.**—A new company has just been formed in the States to amalgamate two of the largest builders of electric motor vehicles—the Baker Motor Vehicle Co. and the Rauch and Lang Carriage Co., of Cleveland, O. The new concern will be known as the Baker R. & L. Co., and has been registered with a capital of £500,000.

**Volunteer Notes.** — Engineering Institutions Volunteer Training Corps. *Company Orders.*—By Lieut.-Colonel C. B. Clay, V.D., Commandant, for week ending August 7th, 1915.

Wednesday and Friday.—Drills, 6.30 and 7.30 p.m. There will be no drill Monday, August 2nd, 1915.

All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. Fleming,
*Company Commander and Acting Adjutant.*

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, July 29th, 1915 :—

*Ongar Camp.*—Thursday, the 29th inst.—The Battalion will parade at 6 p.m., on No. 5 Platform, Liverpool Street Station.

Train arrangements for men not travelling with the Battalion. —An Officer will attend daily (except Sunday), at 8.45 a.m., at the low level entrance, Liverpool Street Station, and conduct to Ongar those men who parade at that time. Members not taking advantage of this opportunity will travel to Ongar at their own expense.

A. G. Joiner, *Captain and Adjutant.*

**Competition with Germany and Austria-Hungary.** —In connection with the campaign undertaken by the Board of Trade, on the advice of their Advisory Committee on Commercial Intelligence, to assist British manufacturers and merchants to secure trade formerly in the hands of German or Austro-Hungarian firms, the Board continue to receive a very large number of inquiries for the names of sellers or buyers of articles of which the sources of supply or markets have been interfered with by the war.

Special arrangements have been made in the Commercial Intelligence Branch of the Board of Trade for dealing with these inquiries, and the weekly list of articles (No. 31), which inquirers desire to purchase, is ready, and may be obtained by United Kingdom manufacturers and exporters of British goods.

British firms interested, as suppliers, in any of the goods mentioned, should communicate with the Director of the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

**Disaster in U.S.A.**—We regret to note that by the capsizing of an excursion steamer at Chicago on Saturday last, a large number of employés of the Western Electric Co., U.S.A., and their relatives lost their lives. Six vessels were embarking employés of the company at the time, and 2,500 persons were on board the steamer which went down, of whom nearly 1,000 were lost.

**Late Legal.**—On Wednesday the jury returned a verdict for the plaintiff in the West Ham case (see page 138) for £350 damages, and judgment was entered accordingly, with costs.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*

**Central Station Officials.**—On Thursday last week, the borough electrical engineer, on behalf of the staff and employés of the Bootle electricity department, presented Mr. E. C. McDonnell first assistant and mains superintendent, with a

handsome marble timepiece and a trousers stretcher, as a token of their esteem, on the occasion of his marriage to Miss M. Ronayne recently. Mr. McDonnell responded, thanking them all for the kindly motive which prompted the presentation.

MR. J. ARTHUR has been appointed engineer-in-charge of the electric light undertaking at Llanfair Caereinion.

The Bispham U.D.C. has decided to increase the salary of the electrical engineer, MR. HOLLINRAKE, by £20 per annum.

The Northampton T.C. has been recommended to appoint MR. E. JORDAN as superintendent at the power station, at a commencing salary of £2 6s. per week, rising to a maximum of £130 per annum.

LIEUT. G. C. MILNES (electrical engineer to the Lancaster T.C.), who was recently mentioned in dispatches for his work in connection with the machine-gun section of the 5th King's Own Royal Lancasters, has been promoted to the rank of captain.

The Plymouth Electricity and Street Lighting Committee has accepted the resignation of Mr. W. J. Spark, the engineer of the Newport Street works, and has placed on record its high appreciation of his services. MR. E. G. OKELL, the engineer of the Prince Rock works, has been appointed borough electrical engineer, at a salary of £600 a year, rising by two annual increments of £25 to £650. The Committee has instructed Mr. Okell to present a report on the reorganisation of the staff at the respective works. It is to accept a similar position at Hartlepool that Mr. Spark is leaving Plymouth.

On the 26th inst., at St. Clement's, Ilford, MR. R. SELLARS, of the West Ham Corporation electricity department, was married to Miss Jewell, only daughter of Mr. and Mrs. Jewell, of Ilford, and late of Brixton. Mr. Sellars's colleagues presented him with a handsome timepiece as a memento of the occasion.

MR. R. M. JOCKEL, charge engineer at the York electricity works, has been appointed engineer at the Malton power station, and will be succeeded by MR. EDWARDS, the present junior charge engineer.

MR. RADCLIFFE WRIGHT, district engineer of the Bishop Auckland area of the Cleveland and Durham Electric Power Co., has been the recipient of a present on the occasion of his impending departure to South America, where he is taking up the position of mains engineer under an Argentine railway company.

MR. ROBT. ILLINGWORTH, lately with the Middleton Corporation electricity department, has been appointed shift engineer at the Accrington electricity works.

**Tramway Officials.**—CORPL. W. ENTWISTLE, who prior to enlisting in the Royal Flying Corps (Military Wing) was an apprentice with the South Lancashire Tramways Co., has just been promoted to his present rank for a daring flight over the North Sea.

**General.**—At Christ Church, Ince (Lancs.), on July 14th, the marriage took place of MR. FRANK BARLOW, eldest son of Mr. Frank Barlow, of Higher Broughton, Manchester, and Miss Mabel Ellison, second daughter of Mr. John Ellison, of Kirkless Hall, Aspull.

MR. CHAS. H. THORPE has resigned his position as engineer-in-charge at the Hammersmith electricity works, in order to take up the position of managing partner in the firm of Morman & Bliss, general and motor engineers, London Road, Hounslow.

MR. A. S. E. ACKERMANN has been awarded a silver medal by the Royal Society of Arts for his paper on "The Utilisation of Solar Energy."

We are informed that MR. THOMAS BRITTEN, manager of Messrs. Crompton's works at Chelmsford, has been elected to a seat on the board of the company.

**Roll of Honour.**—News has reached Glasgow of the death of Captain E. GEORGE TIDD, of the (now) 7th Scottish Rifles (T.), who has been killed in the Dardanelles. Mr. Tidd, who had been associated first with the Volunteers, and later with the Territorials, joined the 6th Highland Light Infantry as a Second Lieutenant, and was promoted Captain in April, 1908. During his 14 years' service in the battalion he proved himself a capable and efficient officer. A partner of the firm of Messrs. Morris, Warden and Co., Ltd., engineers and merchants, 68, Gordon Street, Glasgow, Mr. Tidd was well known in electrical engineering circles, and was chairman of the Scottish Local Section of the Institution of Electrical Engineers five years ago. The deceased gentleman's son, Lieutenant Tidd, is serving with the same battalion in the Dardanelles.

Lance-Corporal BERNARD MOSEY, of the Australian Force, who has died of wounds received in action in the Dardanelles, was formerly an electrician with Messrs. Calvert & Heald, of Lancaster, with whom he served his apprenticeship. He was in Australia at the outbreak of war, and joined the Commonwealth Force at once.

Sergt. D. C. MARTIN, of the 7th King's Royal Rifles, who was on the staff of Messrs. Willans & Robinson, Ltd., of Rugby, has been killed in action in France. He joined at the outbreak of war as a private.

Second-Lieut. H. G. ROGERS, of the 9th Somerset Light Infantry, who has been killed in action in the Dardanelles, was formerly on the staff of the British Thomson-Houston Co., Ltd., Rugby. He obtained his commission last September.

**Obituary.**—SIR SANDFORD FLEMING.—The death is announced from Halifax, Nova Scotia, of Sir Sandford Fleming, the well-known Canadian engineer. He was born at Kirkcaldy, Scotland, in 1827, and when he was 18 years of age he went to Canada. He was engineer-in-chief of the Canadian Government Railways from 1863 to 1880, and while he held that position the railway system of the Dominion was largely extended. Sir Sandford Fleming was the delegate of the Canadian Government to the Colonial Conference in London in 1887, and subsequently to many Cable Conferences. He was one of the foremost promoters of the movement for securing a Pan-Britannic telegraph service, from which the Pacific Cable took its origin, and up to the time of his death continued to advocate the State ownership of a cable system throughout the Empire.

## NEW COMPANIES REGISTERED.

**Comparri Wireless Control Syndicate, Ltd.** (141,009).—This company was registered on July 17th, with a capital of £5,000 in £1 shares, to take over certain inventions and patents relating to wireless control systems and to electric apparatus and appliances for operating and controlling musical instruments and other things, and to adopt an agreement with Manrico Compare. The subscribers (with one share each) are: W. S. Jackson, 1, Greenhill Road, Harrow-on-the-Hill, financial agent; G. E. Bird, 223, West End Lane, West Hampstead, clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. Qualification, 50 shares. Solicitor: I. John Hart, 33, Old Broad Street, E.C.

**Telepad, Ltd.** (141,030).—This company was registered on July 19th, with a capital of £4,000 in £1 shares (1,000 preferred, 1,830 ordinary, and 1,170 deferred), to take over the benefit of patent No. 8,973 of 1913, to adopt an agreement with Sir George W. Kekewich, to carry on the business of manufacturers of, agents for, and dealers in telephone attachments and fittings, appurtenances, utensils, novelties, and devices of all kinds for use in offices and buildings, electrical and general engineers, stationers, printers, etc. The subscribers (with one preference share each) are: Sir George W. Kekewich, K.C.B., Feltham, Middlesex; W. J. Cameron, M.B. (Lond.), Two Oaks, Balham Park Road, S.W.; H. W. White, 28, St. James Square, Holland Park, W., merchant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Solicitor: J. Clarke, 7, New Square, Lincoln's Inn, W.C.

**Phœnix Armouring and Cable Co., Ltd.** (141,042).—This company was registered on July 20th, with a capital of £1,000 in £1 shares, to carry on the business of cable armourers, cable makers, ironfounders, mechanical and electrical engineers, tube and boiler makers, fitters, etc., and to adopt an agreement with F. Pugsley and I. S. Watts. The subscribers (with one share each) are: F. H. Pugsley, 85, Ullswater Road, Southgate, N., manufacturer; I. S. Watts, 130, Argyle Road, West Ealing, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are F. H. Pugsley and I. S. Watts (managing directors for seven years at £200 each per annum). Qualification, £100. Solicitors: Reginald Bell & Co., 3-7, Southampton Street, W.C.

**Smethwick Machine Shops, Ltd.** (141,067).—This company was registered on July 22nd, with a capital of £2,000 in £1 shares (500 pref.), to carry on the business of ironfounders, mechanical and electrical engineers, manufacturers of steel and iron tools, implements and machinery, munitions of war, electrical machines and fittings, engines, motor-cars, cycles and accessories, and hardware of all kinds, metal workers, millwrights, machinists, etc. The subscribers (with one share each) are: C. G. Garrard, Goldthorn Road, Wolverhampton, engineer; S. Egerton, 17, Paignton Road, Edgbaston, Birmingham, secretary. Private company. The first directors are C. G. Garrard (chairman) and S. Egerton. Solicitor: A. E. A. Langhorne, 41, Temple Row, Birmingham.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Anchor Cable Co., Ltd.** (69,073).—Capital, £250,000 in £10 shares. Return dated May 20th, 1915. 6,500 shares taken up; £10 per share called up on 6,100; £61,000 paid; £4,000 considered as paid on 400 shares. Mortgages and charges: £50,000.

**Electro Chlorination Syndicate, Ltd.** (109,699).—Capital, £50,000 in 48,000 pref. ord. shares of £1 each and 40,000 def. ord. shares of 1s. each. Return dated December 31st, 1914 (filed May 21st, 1915). Seven pref. ord. shares taken up; nothing called up. Mortgages and charges: Nil.

**Pernambuco Tramways and Power Co., Ltd.**—Issue on July 6th, 1915, of £50,000 debs., part of a series of which particulars have already been filed.

**Porlock and District Electric Supply Co., Ltd.**—Debenture and, as further security thereto, a mortgage, both dated June 24th, 1915, to secure £250, charged on Higher Mill, at Hawkcombe Porlock, Somerset, water rights and company's other assets, present and future, including uncalled capital. Holder: C. Blackford, Porlock, Somerset.

**Pope's Electric Lamp Co., Ltd.** (101,293).—Capital, £25,100 in £1 shares (25,000 pref. and 100 ord.). Return dated October 12th, 1914 (filed May 15th, 1915). 22,579 pref. and 100 ord. shares taken up; £4,254 paid; £18,425 considered as paid. Mortgages and charges, £1 (sic).

**Julius Sax and Co., Ltd.**—Mortgage debenture, dated July 9th, 1915, to secure £1,000 (ranking *pari passu* with £2,500 issued in 1908), charged on company's undertaking. Holder: P. C. Rowe, Newlands, Leatherhead, Surrey.

**Frinton-on-Sea and District Electric Light and Power Co., Ltd.**—Particulars of £4,000 third debs., created July 1st, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to first and second mortgage debs., and money secured thereby, amounting to £6,000. No trustees.

**National Alloys, Ltd.**—Debenture, dated July 2nd, 1915, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Edward le Bas, Dock House, Billiter Street, E.C.

**Naylorgraph, Ltd.**—Debenture, dated June 24th, 1915, to secure £550, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. M. Hunt, Fairlawn, Park Road, Southborough.

**Birmingham Central Supply Co., Ltd.**—Particulars of £300 debentures, created July 14th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

## CITY NOTES.

### Electric and General Investment Co., Ltd.

The report of the directors for the year ended May 31st shows that the gross profit on the transactions for the year was £7423. After deducting all general charges, interest on debenture stock, transferring £2,409 to reserve, and adding £3,075, the amount brought forward from last year, there remained a balance of £5,222, which the directors recommend should be carried forward. The amount of £84,000 appearing as a provision for contingencies in the last balance sheet has been debited with the sum of £4,255 in respect of losses incurred, and after transferring thereto the sum of £2,409 from profit and loss, there remained a balance of £82,154, which has been deducted from the value of the company's investments and retained as an investment reserve fund. Mr. Emile Garcke retired from his office as a director by rotation, and, being eligible, offered himself for re-election.

Mr. J. B. Braithwaite presided over the 26th ordinary general meeting, held at Winchester House, Old Broad Street. In proposing the adoption of the report, the Chairman said it was the first time in the course of the twenty-five years' existence of the company that the ordinary shareholders had had to go without a dividend. Of course, the conditions were quite exceptional, and when they looked back over the record of the past twenty-five years he thought they would agree that they had not done so badly. During that period they had paid them the equivalent of £6 for each £1 share, which worked out at an average of about 25 per cent. per annum. He thought they would agree that under the exceptional circumstances they had had to face this year they must be content to take something from their past dividends, and reduce that average a little. For ten months out of their financial year they had had a state of war prevailing, which had entirely put a stop to financial business of almost every kind. The net result of the year was that they had transferred £2,409 to the contingencies fund; they had paid £497 on account of the preference dividend, and they carried forward £5,222, which was within £100 or £200 of the balance of the preference dividend. As they knew, the dividend was cumulative, and they hoped to make a distribution as soon as financial conditions improved. They did not consider it wise to borrow for the purpose of paying the dividend on this occasion, but to reserve their cash resources as much as possible. He regretted that there was no dividend for the ordinary shareholders, but on the whole he thought they had done fairly well under the circumstances in being able to show that the preference dividend had been earned.

Mr. E. Garcke seconded the motion, which was carried unanimously.

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**Calgary Power Co., Ltd.**—The report states that, considering conditions, business has been quite satisfactory. The gross earnings amounted to $231,186, compared with $240.116 for 1913, and the net earnings to $180.207, compared with $188,060. After deducting interest charges ($155,479), $24,728 was transferred to surplus account, leaving the balance at credit of that account $180,383. Both gross and net earnings were affected to the extent of about $27,500 by a fire which caused a suspension of operations for six months in the large cement mill at Exshaw, which is an important power customer. The prevailing economic conditions also prevented customers from taking normal amounts of power. All construction was finished early in the year. The new Kananaskis Falls power plant has given entire satisfaction in operation, as has the system as a whole. In the absence of unforeseen contingencies, the operating expenses during 1915 will be considerably lower than in either 1913 or 1914, notwithstanding that two generating plants are now in operation. Under the existing contracts for the sale of power the company is assured of a minimum income sufficient to meet operating expenses and bond interest, and still leave a substantial surplus. The city of Calgary has constantly taken power in excess of the minimum specified in its contract, and will undoubtedly continue to do so in the future.—*Financier.*

**Bristol Tramways and Carriage Co., Ltd.**—The directors have declared an interim dividend at the rate of 4 per cent. per annum for the half-year ended June 30th. The dividend warrants will be posted to the shareholders on Wednesday, August 4th.

**Metropolitan District Railway Co.**—Interim dividend on the 4 per cent. guaranteed stock at the rate of £4 per cent. per annum, on the first preference stock at the rate of £4 10s. per cent. per annum, and on the second preference stock at the rate of £3 per cent. per annum.

**Bournemouth and Poole Electricity Supply Co., Ltd.**—The directors have declared an interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less income-tax.

**Central London Railway Co.**—Interim dividend on the undivided ordinary stock at the rate of £3 per cent. per annum, and on the preferred ordinary stock at the rate of £4 per cent. per annum.

**City and South London Railway Co.**—Interim dividend on the whole of the outstanding 5 per cent. preference stocks 1891, 1896, 1901 and 1903, at the rate of £5 per cent. per annum.

**The Rosario (Argentina) Electricity Co.** — The accounts of the Société d'Electricité de Rosario, which is a Belgian company, and in which the Berlin Company for Electrical Undertakings is interested, show gross profits of £82,000 for 1914, as compared with £99,000 in the previous year. The less favourable result is attributed by the directors to the reaction of the European war on the economic situation in the Argentine Republic and the resulting diminution in the demand for electricity; whilst the consumption of the company's chief customer—the Rosario Tramways Co.—also declined by about 10 per cent. as compared with 1913. After making provision for depreciation and reserve funds, the balance of net profits permits of the payment of a dividend of 5 per cent. on the ordinary shares, as against 8 80 per cent. in 1913. The "dividend shares," upon which 3s. per share was paid in 1913, receive no distribution for the past year.

**Northern Ontario Light and Power Co., Ltd.**—The report states that the results would have been better but for the unsettled conditions since August 1st, 1914, which have made a difference of approximately 10 per cent. per month in the anticipated earnings during the past five months. The sum of $142,758 has been paid as dividends at the rate of 6 per cent. on the outstanding cumulative preference stock. The balance of $564,496 (including $316,442 surplus brought forward, after adjustments of $6,598) has been carried forward. The sum of $133,500 has been applied in settlement of the year's instalment of sinking fund on the bonds (against $122,000 in 1913), making the total amount of the bonds in this fund $321,000. During the year $133,500 bonds have been issued, leaving certified but unissued $181,500. In addition, the company is entitled to have certified and issued, because of money expended out of earnings on improvements and betterments, approximately $405,500 bonds.—*Financier.*

**Russian Joint Stock Companies.**—A German newspaper, referring to the accounts of Russian joint stock companies for the year ended last December, states that the first place from the standpoint of favourable financial results was occupied by the companies engaged in the electrical, metal-working and engineering trades. In particular, the electrical manufacturing works, which had on hand considerable stocks which were purchased at low prices prior to the war, realised record profits. It is contended that the enormous import requirements of Russian industries, especially in regard to raw materials and machinery, will compel the Russian companies also, after the conclusion of the war, to make purchases abroad and take advantage of foreign exchange, notwithstanding all the existing efforts made for the purpose of Russianising industries.

**Metropolitan Railway Co.**—The result of working for the six months ended June admits of the payment of the dividends on the several issues of preference stock and of an interim dividend at the rate of 1 per cent. per annum on the ordinary stock. The latter payment compares with 1½ per cent. paid in respect of the first half of 1914. The Surplus Lands Committee announces that the balance for the half-year ended June 30th, 1915, will allow of the payment of an interim dividend on the Surplus Lands stock at the rate of 2¾ per cent. per annum.

**Aldershot Gas, Water and District Lighting Co., Ltd.**—The report states that the total revenue for the year was £51,456, and expenditure £39,784, leaving a surplus of £11,671. After providing for dividends on consolidated preference stock and interest on special loan and debentures, the directors recommend the full statutory dividends of £5 18-20 per cent. per annum on the "A" stock, £4 8-20 per cent. per annum on the "B" stock, and £5 per cent. per annum on the "C" consolidated stock for the half-year all less tax.—*Financier.*

**Brazilian Traction, Light and Power.**—The directors have declared a quarterly dividend of ½ per cent., as compared with 1½ per cent. a year ago, payable in Toronto on September 1st. In view of the unsettled conditions and notwithstanding that the earnings of the company have continued to increase in a very satisfactory way, the directors have decided on making the dividend on the common stock for 1915 at the rate of 4 per cent. per annum. —*Financial News.*

**County of London Electric Supply Co., Ltd.**—The directors have declared an interim dividend on the preference shares at the rate of 6 per cent. per annum, less income-tax, for the half-year to June 30th, and an interim dividend on the ordinary shares for the same period at the rate of 5 per cent. per annum, less income tax, both payable on September 15th.

**The Roumanian A.E.G.**—It is stated that the Roumanian A.E.G., which is the sales organisation of the Berlin company in Roumania, realised net profits £6,000 in 1914, as compared with £6,200 in the preceding year. The dividend is at the rate of 10 per cent. on share capital of £50,000, this contrasting with 5 per cent. in 1913.

**National Gas Engine Co., Ltd.**—The directors have decided to pay an interim dividend for the six months ended June 30th at the following rates:—5 per cent. per annum on the preference shares, and 7½ per cent. per annum on the ordinary shares, both subject to income-tax. The dividend warrants will be posted on the 31st inst.

**London Electric Railway Co.**—Interim dividend on the 4 per cent. preference stock at the rate of £4 per cent. per annum, and on the ordinary shares at the rate of £1 per cent. per annum.

## Marconi's Wireless Telegraph Co., Ltd.

THE report of the directors for the year ended December 31st, 1914, shows that the gross profit for the year amounted to the sum of £371,072, and the net profit carried to the balance sheet to £232,716, showing an increase of net profit over the preceding year of £110,392. The net profit of the year, added to the sum of £76,550 brought forward from the previous year, increases the balance now to the credit of profit and loss account to £309,266. The basis of remuneration from the Government for the use of the company's high-power stations since the beginning of the war and other services not yet having been settled, it has not been possible to include any sum in respect of them in the profit and loss account of last year. These items will, therefore, have to be entered to the credit of the account of the current year. In the balance sheet, shares in associated companies and patents are again taken into account at their cost price, viz., £1,360,126, showing an increase of £61,382. This addition is mainly composed of the company's proportion of the increased capital of the Russian Co. The company's holdings in associated companies, except for these additions, have undergone no change during the year under review. The par value of shares held in associated companies now stands at £2,469,859, exclusive of shares which have no capital denomination. The amount which stood to the credit of share premium account has been transferred to general reserve account, which now stands at £867,530.

The French Company (Compagnie Française Maritime et Coloniale de Telegraphie sans Fil) has declared a dividend for the year 1914 at the rate of 10 per cent. on the ordinary shares and 31.25 francs per share on the founders' shares.

The Marconi International Marine Communication Co. has again shown substantial increase of business and profits. Dividends for the past year amounting to 10 per cent. have been declared, and the sum of £30,747 was placed to reserve and carried forward.

The Russian Company (Société Russe de Télégraphes et Téléphones sans Fil) has made satisfactory progress. A dividend at the rate of 15 per cent. for the year 1914, as compared with 6 per cent. for the previous year, has been declared.

The Marconi Wireless Telegraph Co. of America earned increased profits for the year, but owing to the conditions prevalent in Europe, and the consequent necessity to defer the opening of their trans-Atlantic service, the directors decided meantime not to declare a dividend.

The outbreak of war caused considerable dislocation of the company's affairs as well as of those of the associated companies. Businesses of importance which were on the point of fruition had to be deferred; many negotiations which were in course of successful progress with foreign Governments had for the time being to be abandoned; the opening of the direct public telegraph services between this country and the United States of America and Spain had to be postponed. In some cases, owing to the unfavourable rates of exchange, substantial sums had to be deposited at interest with bankers abroad, and some payments from foreign Governments deferred with interest accruing until after the war. The sum of £4,347 due from the Turkish Government has not been received. In these circumstances the directors recommend the declaration of a dividend of 10 per cent. upon the ordinary shares; to place a further £100,000 to general reserve account, increasing that account to £967,530, and, after deducting the dividend of 7 per cent. paid earlier in the year upon the preference shares, to carry forward the sum of £69,497. The directors do not contemplate that any loss in consequence either of loss in exchange or deferred payments will result. During the current year the company has been engaged to its fullest capacity in supplying the demands of the British, Colonial and Foreign Governments. The orders in hand justify the anticipation that the volume of business this year will exceed that of any previous year. With extreme regret the directors record the deaths of two of their colleagues, General Albert Thys and Major Samuel Flood Page, who were actively associated with the company for some fifteen years. The directors retiring at this meeting were Mr. Henry S. Saunders and Mr. Samuel Geoghegan, who, being eligible, offered themselves for re-election.

Senatore G. MARCONI (Chairman) took the chair on Monday, at the Hotel Metropole, at the annual meeting of the company. In moving the adoption of the report, he said he had little doubt that the statement of accounts would be regarded in all the circumstances as satisfactory. In the balance sheet, on the debit side capital remained practically unchanged, bills payable showed a slight increase, and sundry creditors somewhat less than the figures of the preceding year. The reserve account now carried with it the share premium account, which they had transferred. On the credit side, the amount to the credit of temporary investments and loans against securities represented moneys for which they had no immediate need, and which, therefore, had been lent against or invested in first-class securities, earning a better interest than could be obtained by placing the money on deposit at the bank. Sundry debtors showed an increase approaching £250,000 over the figure of the preceding year; practically the whole of this increase was in respect of Government work, and nearly the whole of it had since been received. Shares in associated companies showed an increase of some £60,000, the greater part of which was represented by an increase in their holding in the Russian Co., by reason of the growth of their business and the increase of the capital, of which they took their proportion. The par value of their total shareholding was now close on 2¼ millions sterling, but the figure appearing to the credit in the balance sheet represented, as usual, the actual cost to the company. Turning to the profit and loss account, on the debit side there was the substantial balance amounting to £232,716 8s. 11d. profit carried to balance sheet. This figure showed a marked increase over the profit of the preceding year, proportionate, of course, to the increase in contracts, sales, and trading account. The amount of work which had been done for the Government and the services rendered were considerable, and they had very little doubt that the remuneration which would be awarded the company in due course would be proportionate to their value. On the outbreak of hostilities, as was to be expected, wireless telegraph apparatus was promptly declared contraband of war, and for the time being, therefore, their work in many parts of the world practically came to a standstill. Their programme had undergone complete dislocation, and it was quite impossible at the present moment to say to what extent or in what way it would be affected eventually. On the other hand, their factory had been kept very fully occupied in carrying out the very important orders which they had received; the greater part of this work, however, would figure in the accounts of the present year. The American Co. had been deprived of the use of their trans-Atlantic station owing to the stations on this side being required for other purposes. It was hoped that in due course they would receive fair compensation. Their high-power stations, however, at San Francisco and Hawaii had been completed and a telegraphic service was being conducted very satisfactorily. They were daily awaiting information with regard to the opening of the service through to Japan, and arrangements had been made with the Japanese Government for the conduct of a commercial telegraph service. The Canadian Co. had continued to make progress, but the changes which were contemplated had not yet been carried out, owing to the war. The Argentine Co. had had to defer for the present work upon their high-power station. The Belgian Co. continued to conduct its business from their office in Marconi House under the direction of the English directors of that company, Mr. Godfrey Isaacs and Captain Sankey. The business was progressing satisfactorily, but it had been quite impossible to make up any balance sheet. The French Co. had continued to do a satisfactory business and had paid for 1914 a dividend similar to that of 1913. The Marconi International Marine Communication Co., Ltd., had continued to show satisfactory progress, although it had not been altogether free from loss directly arising from the state of war. Their Russian Co. had had a very good year and had paid a dividend of 15 per cent., as compared with 6 per cent. for 1913. They had a considerable amount of work in hand and were doing a very satisfactory business. The Spanish Co.'s negotiations with the Spanish Government, to which reference was made last year, were not facilitated by the outbreak of war. They had, however, continued to make progress, and were approaching an early and satisfactory termination. The development of the Automatic Telephone Co. had not made much commercial progress, in consequence of the war. The name of the company had been changed to that of "The Relay Automatic Telephone Co." as the Swedish name under which it traded was liable to be mistaken, which would not have been to its advantage. They had signed an important contract with the Italian Government, which they contemplated would be put into operation in the early future. With regard to the Imperial chain, they would remember that in the report of last year the directors informed the shareholders that they were permitted to make but slow progress with the erection of the six high-power stations for which they had contracted with His Majesty's Postmaster-General, and the company's interests were being seriously prejudiced thereby. Within a few days of their general meeting war was declared, and at the end of the year the Postmaster-General informed the company that, owing to altered circumstances resulting from the war, the Government had decided not to proceed with the Imperial wireless chain. They were further informed that the governing factors in determining the Imperial scheme would be better met by means other than the construction of stations of the character and in the situations contemplated by the contract for the Imperial chain, and that the amounts disbursed by the company in respect of the contract would be refunded to them. Subsequently, in February, negotiations were entered into with His Majesty's Government for the erection of certain stations on conditions differing from those contained in the original scheme. Negotiations were proceeding on a basis which, if agreed to, would represent to the company a reasonable equivalent of the terms of the 1913 contract. Nothing, however, had yet been definitely decided. Since he last addressed them there had been some important developments in the art of wireless telegraphy, and they had applied for several new patents. The company had received more than one letter of appreciation from the Lords Commissioners of the Admiralty in respect of the work they and members of their staff had done. It would interest them to know that from their companies some 1,100 men were employed in the forces on active service or on special duties, apart from the very large number at the head office and works who had been requested to remain at their posts, where by so doing they could render greater service to the country. On behalf of his co-directors and himself he wished again to

place on record their high appreciation of the services rendered to the company, and he might also say to the British nation and her allies, by their managing director, Mr. Godfrey Isaacs. He had continued untiring in his work and activities, and it would be difficult to over-estimate the value of his services. It was very largely due to him that wireless telegraphy had become and had remained a great British industry, of, perhaps, greater value to the nation during war time than in peace.

Mr. Godfrey Isaacs (managing director), in seconding the motion, said he proposed to take advantage of the opportunity to tell them something about the company, and something about the competition which the company had experienced, which at no other period had it been possible for him to speak about. He wanted to remind them that he joined the company on January 25th, 1910, at Mr. Marconi's invitation. At that time the company had an issued capital of £547,299. It had practically no cash resources whatever, and it had no credit. It had been extremely difficult to find money in this country for wireless telegraphy. Mr. Marconi had personally made great efforts to find the necessary moneys to conduct the business of the company, and he only succeeded by going to Italy to obtain there a substantial subscription to the preference issue which was at that time made. When he joined the company in 1910, Mr. Marconi personally lent the company £12,000, and he then proceeded to Canada upon the company's business. Within a few weeks of his absence he (the speaker) had to draw a cheque upon his own banking account to pay salaries which were due on the Saturday morning for the preceding month. That day they had a capital issue somewhere approaching 1½ millions sterling, and their balance sheet showed they were in a very sound position and that their assets were sound assets. They had to-day nearly one million sterling to the credit of their general reserve account, and they had very large assets in the shape of cash, first-class securities, and freehold and leasehold property. The leasehold property, although it appeared at cost less depreciation, they could dispose of that day at a very substantial profit, and had received more than one offer. They had in addition a large number of shares in their associated companies, most of which had that day a very substantial value, and all of which they hoped in the future would be of a very big value. He wanted to tell them some of the reasons why the business did not prosper in its first years. He thought it was very desirable that they should have an insight into the history of the company, which heretofore had of necessity, for reasons which they would all understand, been a closed book. Very soon after Mr. Marconi provided the company with this very valuable invention the methods which obtained abroad were adopted with regard to his science, and the very valuable patents which were then their company's property alone were imitated in Germany, and with the great ability of the German people, and their great foresight, a big German company was created. This German company had for its direction some of the most eminent and able commercial men in Germany, who were then the directors of some of the biggest commercial industries in that country. It had, further, the great advantage of the financial aid of some of the principal German banks, and, finally, it had a very large subsidy from the German Government. That was the position of the company against which the Marconi Co. for many years up to the time he joined the company, and subsequently, had to contend. Mr. Marconi personally, with the aid of his managers, had for many years succeeded—in his opinion marvellously—in maintaining something of the position of the English company, notwithstanding the very powerful opposition of the German company. He thought it was largely due to the magnificent support given to the company, or perhaps it would be more correct to say to Mr. Marconi personally, by the Italian Government, notwithstanding that they were the allies of the German company's Government, that the company was able to continue its existence. The German company, no doubt under the direction, to a large extent, of the German Government, proceeded to create powerful agencies in pretty well every country in the world, and they made great headway. With the exception of Italy, France, and this country they did obtain a preponderating position in this industry in practically every part of the world. That was the position he found in 1910. Wherever one went, whatever negotiations one had with foreign Governments, one was always in competition with a powerful German agency. But that was not all. They had not only to contend with the German agents, but they had also to contend with the German ambassadors. They eventually found that their position was impossible under such conditions. He returned from a journey abroad and made an immediate appeal to Sir Edward Grey, and placed the facts before him, and from that time forward he obtained the support of the British Ministers abroad in their different negotiations with foreign Governments, and from that time, also, they commenced to make substantial progress until they reached undoubtedly the preponderating influence in the industry throughout the world. It was easy to understand that a company like the German company, which had the support of the German Government and conducted the greater parts of its business under the direction of the German Government, always with the aim of obtaining contracts and concessions for the construction of wireless telegraph stations in foreign countries, and having in view the importance which they one day would play, and with the prospect that when a German station was built German hands would work that station, that it mattered little or nothing to the German company, with its Government behind it, at what price it entered into contracts for the construction of these stations Under those circumstances, he thought they would agree that it was not easy for the Marconi Co. to maintain its own. Within three months of his joining the company it was evident to all of them that the future of the company lay in a commercial wireless telegraph service round the world, and they adopted the policy of creating such a service, and one of their first acts in April, 1910, was to apply to the British Government for the right to erect high-power stations in all British possessions. They stated at the time that they were determined to create this telegraph service, upon British soil if possible, but they had made up their minds that the stations were to be built. Unfortunately, the Government did not see its way to grant them that right. They asked for no money, but merely proposed that they should be at their own expense in building the stations and in working a commercial service in peace time, and that in case of war they would hand over the stations to the Government for Government purposes. It was regrettable that they were not enabled in 1910 to proceed with that programme. Out of it was born the Imperial chain, and, as they would remember, when that was mentioned in Parliament, it received most hostile criticism on the grounds that it was alleged that the company were receiving terms far too favourable to it. Immediately the matter was mentioned the German Government resolved to build a chain of wireless stations in all German colonies. The matter was not discussed in the German Parliament, but the stations were immediately proceeded with. He was informed, and he believed correctly, that the price the German Government paid for each of these stations was three times the price which their company had asked of the British Government. Besides that price, which provided for a very handsome profit, the German Government gave a subsidy far more than was ever contemplated by the Marconi Co. that they would get from the royalty for Imperial stations; and that subsidy was to be paid, not for 18 years, but for 25 years. The stations were built and, he believed, cost the German Government £2,000,000. In the light of what had subsequently happened, they might say it was a very bad investment, but if they did they would be mistaken. War was declared between this country and Germany at midnight on August 4th. At five o'clock in the evening of August 4th Germany sent out a message to all its wireless stations, and each stations sent it out to sea, covering a radius of 2,000 miles or more, to this effect: "War declared upon England; make as quickly as you can to a neutral port." By that message, which occupied but a few minutes, Germany contrived to save the greater part of its mercantile marine. If it saved only one of its big ships, like the *Vaterland*, it would have paid for the whole cost of its wireless stations. They all knew that it was a great deal more than that, but he did not think he was permitted to go further and tell them any more than he had told them. He had given them that information because he thought it was right that they should understand a little of what the Marconi Co. had had to contend with in endeavouring to maintain its position in the world in this industry. He also had told them because he wanted them to understand the reasons for the conservative policy the board had determined upon at this time. They contemplated, when the war was over, in consequence of the very big value which wireless telegraphy had proved itself to have, there would be a very considerable business to be done with a great many foreign countries, but they were mindful that when that time came it was possible that, owing to financial stress which might reign for a period, many foreign Governments would defer entering into engagements, which otherwise they would be willing to do, if the company were not able to some extent, for some little period, to finance the work which they undertook for them. He did not know what was likely to be the position of their competitors when the war was over, but, in any case, they did not propose to take any chances. They contemplated, therefore, harbouring their resources, so that when the time came they would be able to undertake the business which would be offered to them. Further, they must recognise that they might be called upon to render some financial assistance for a period to some of their associated companies, and there was no doubt the mother company would have to be prepared to be their bankers in case of need. Mr. Isaacs proceeded to refer to the loyal support he had received from the Chairman and his colleagues on the board, from Mr. Bradfield (the manager), Mr. Allen (the assistant manager and secretary), and the engineering staff. He remarked on the Chairman's presence that day, and said that Mr. Marconi in carrying out his military duties for the Italian Government had been nearer to the Austrian shells than he cared to think of. In conclusion, he pointed out that the balance sheets for the past five years showed the company had made a net profit of close on £1,000,000, which, in face of the difficulties they had had, he did not consider a bad result.

Mr. Lanham congratulated the board and Mr. Isaacs, and said that he had opposed the managing director in the past, owing to the fact that, in common with other shareholders, "he did not know." He suggested that the board might give some idea of what the company was likely to get from the Government for services rendered.

Mr. ISAACS said he could not form any estimate of the amount likely to be received from the Government.

The report was adopted, and the meeting further passed a resolution for altering the articles of association.

## British Electric Traction Co., Ltd.

AN extraordinary meeting was held on Friday last, at the Holborn Restaurant, under the chairmanship of Mr. E. GARCKE, to consider the proposed scheme, which was outlined in our last issue, for re-arrangement of the capital of this company.

The CHAIRMAN, in proposing a resolution approving of the scheme, said the assets of the company stood in the books at £5,056,000. They proposed to write off net £908,000; that was to say they estimated that the assets were short of the capital and liabilities by 3s. 7d. in the pound. The two debenture stocks, representing £1,800,000, were not affected by the scheme. The other capital, amounting to almost three millions, was at present divided into four classes—two preference stock and two ordinary stocks, and those four classes all ranked equally as to capital without any priority one over the other. The capital of the preference stocks was not to be reduced, but it would be re-arranged. The reduction of capital fell entirely on the ordinary stocks—50 per cent. was written off the preferred ordinary stock, and 70 per cent. off the deferred ordinary stock. Then there were the income certificates amounting to £266,000, which, however, had no capital rights. It was proposed to cancel these certificates and give the holders capital stock to the extent of 35 per cent. of the nominal amount of the certificates. It was proposed to convert the four classes of stock and the income certificates into two classes of stock—preference and ordinary. The new 6 per cent. cumulative preference stock would have priority of capital over the new ordinary stock, and would, with its rights of participation in further profits, be in every respect a most attractive stock. The ordinary stock would rank after the preference stock as regarded both capital and dividends, but as a result of the reduction of capital it was hoped this stock would at once become dividend yielding, and that the dividends would gradually increase, which would be an advantage also to the holders of new preference stock, as the market values of the debenture and preference stocks would improve with the improvement in the ordinary stock. The preference stock would be allotted as follows:—To the holders of the existing 6 per cent. preference stock, an amount equal to the present holdings; to the holders of the existing 7 per cent. non-cumulative stock, 35 per cent.; and to the holders of income certificates, 10 per cent. The new ordinary stock would be allotted as follows:—To the holders of the existing 7 per cent. non-cumulative preference stock, 65 per cent. of their holdings; to the holders of the existing preferred ordinary stock, 50 per cent. of their holdings; to the holders of the existing deferred ordinary stock, 30 per cent.; and to the holders of the income certificates, 25 per cent. It was quite possible that some of the stockholders might not approve the scheme in all its details. They had to consider the subject in its broad aspects, and to decide whether or not they wished to have a reduction and re-arrangement of capital, and, if so, whether in principle the scheme was, taking a large view, fair to all interests. In a complex matter of this kind, it was quite natural for individual stockholders to look at it from the particular point of view affecting their special interests, but no scheme of this character could be formulated and carried through if they commenced by trying to satisfy each particular point of view. They must first deal with principles, and then, if they agreed that they were proceeding on the right lines, opportunities would be found for discussing the details. In his circular to the stockholders of July last year, he explained that unless they reduced the capital in order to clear away the depreciation of assets it would be impossible to pay substantially increased dividends, and he explained also why a simple reduction applied equally to the four classes of stock would not meet the case, and why a re-arrangement of capital as well as a reduction of capital was necessary. At the last general meeting he explained the reason why the directors thought it better to go on with the scheme now instead of postponing it. In the opinion of the directors there was no doubt as to the advisability of completing the matter sooner rather than later. For some years to come, not merely during the war, but for some time after the war, all industrial companies would be confronted by exceptional difficulties. It would then be a great advantage to the company in its corporate capacity, as well as to the stockholders personally, if the profits which before a reduction of capital were applied to reserve for depreciation become available for dividend or, alternatively, to strengthen the credit of the company. The next point of principle they had to consider was whether the reduction of capital proposed was adequate for the purpose of completely rehabilitating the company. With regard to this point, he could only refer them to the statements Mr. Tegetmeier and himself made at the annual meeting in 1913. He then said that the depreciation of the investments, having regard to the reserves which had been made by the associated companies themselves, could be met by the existing reserves of the company, supplemented by a sum which approximated to between two-thirds and three-quarters of a million. To be on the safe side, however, the board decided to recommend them to write off £900,000, and in view of the further depression caused by the war, the decision was a wise one. At the last general meeting he stated that they saw no reason to alter those valuations. Of course, they all knew that the market depreciation was much larger than this figure—the market depreciation of the capital stocks was about £2,000,000, but a large part of the market depreciation was due not only to the fact that their investments were depreciated, but also to the fact that they were not paying adequate dividends on the whole of the capital. Consequently, if they could by a reduction of capital, to an extent equal to the depreciation of assets, coupled with a re-arrangement of capital, enable the company to pay dividends on the reduced capital, they would in due course recover that part of the market depreciation which was due to their not paying adequate dividends on the present capital. The great merit, therefore, of the scheme was that by a reduction of capital by £900,000 they hoped in course of time, as dividends increased, to remove the whole of the market depreciation of about £2,000,000. There was one misapprehension he would like to remove. It had been said that this scheme had been rendered necessary because the re-arrangement of capital in 1911 was not drastic enough. But the re-arrangement of capital in 1911 was not intended to be at all drastic. It did not involve any reduction of capital whatever. If a reduction of capital had been attempted at that time it would have been a very serious matter indeed; it would have been a very much more drastic reduction of capital than that which they were able to propose now. They did not try to avoid responsibility for any mistakes they had made in the past, therefore they might be allowed to feel satisfaction with the way they had been able to steer the ship out of troubled waters, and were it not for the heavy war clouds, they should now be looking towards a clear horizon. It was very difficult to see into the future at present, otherwise he should have no hesitation in promising a complete recovery of their loss to those stockholders who were able and willing to take their courage in both hands by commensurately increasing their holdings in the company at the low prices now prevailing. How far this deplorable war and its consequences should modify this confidence the shareholders were as well able to judge as he was. He firmly believed that if the scheme was carried out it would place the company in a stronger position to meet the difficulties with which they would all be confronted as a result of the war, and would, he hoped, enable the company when the war was over to start on a new career of prosperity with its optimism tempered by past adversity and its energies guided by long and deeply ingrained experience of both success and failure. He added that the directors had received proxies in favour of the scheme from 1,400 stockholders representing £1,200,000 of capital, while they had only received 77 proxies against it representing capital of between £7,000 and £8,000.

Mr. ALFRED SHEPHERD, a member of the shareholders' committee appointed in 1911, at the time of the previous re-arrangement of the capital, seconded the resolution. He remarked that, on the whole, he considered the scheme a good and reasonable one in the interests of the four classes of stockholders, and unless some such scheme was agreed upon the company would never be able to recover the position it once held.

Replying to criticisms on the scheme, Mr. P. D. TUCKETT said he believed that the preference stockholders had as much to gain from it as anyone. For many years he had been in favour of reducing the capital, because he felt that substantial losses had been incurred which it was better to write off than continue to carry on their books.

The CHAIRMAN said he thought they might take the discussion as indicating that the meeting supported the scheme in principle, and it could be discussed in detail at the separate meetings which would have to be held later.

On a show of hands the resolution was carried by 34 votes to 4, being more than the requisite three-fourths majority to carry it.

## STOCKS AND SHARES.

TUESDAY EVENING.

THE Stock Exchange, these war-days, seems to be always waiting for something or other. It cannot get going. Business has to move at snail's pace because there is this or that particular cloud hanging over, and close over, the financial horizon. Two factors operating at the moment are the opening of the market in the new War Loan and the position of Warsaw. To what price the 4½ per cent. War Loan is likely to settle down is a consideration that imposes a check upon investment in other securities. The fate of Warsaw is keenly watched because the fall of the town might result in the prolongation of the war, and therefore the cost be increased, with its inevitable sequel of more national borrowing, to the detriment of investment securities all round.

Markets, consequently, remain quiescent to dull. Home Railway dividends are not at all bad, and those of the Tube companies are decidedly good. Telegraphs are depressed by would-be realisations of deceased accounts. Home Railway dividend declarations make a tolerably good showing as a whole, while the electrical companies have done well. The Metropolitan is the only one in the latter group to pay a smaller rate than that of a year ago. Central London announces its regular 4 per cent., the District pays 3 per cent.

on its Second Preference—as it did last year, when an improvement of ½ per cent. was established over the 1913 dividend. Underground Electric Income bonds get their full 6 per cent., a somewhat pleasant surprise that has not been reflected in the price so far. The City & South London has declared dividends on all its preference stocks: six months back the 1901 and 1903 issues had to go without distributions.

Central London ordinary has changed hands this week at 73½, and having regard to the stocks behind it which are receiving their full dividends, the 4 per cent. guaranteed interest looks reasonably secure. The non-assented ordinary stock has not been dealt in since May, when the price marked 40. This year's solitary bargain in all four preference stocks was done last March, in the 1903 issue, at 80. London Electric 4 per cent. preference stands about 63; the company is to pay 1 per cent. on its ordinary shares.

Electric Lighting shares are mainly lower in consequence of the outlook with regard to coal. The County of London has declared its accustomed dividend at the rate of 5 per cent. on the ordinary shares, but the price has fallen ½ to 10½, and the preference at the same price are equally lower, while the debenture stocks of this, and of the City company, have been impartially marked down by about five points apiece. South Londons, which have been scarce for a long time past, have been offered to a small extent at 3½. South Metropolitans had no difficulty in finding a home at about 15s. 6d., and more could probably be placed at about the same figure. Citys are easier at 13, and the preference at 11, the latter registering a fall of £1 in a fortnight. The market as a whole is slightly inclined to depression.

There is no change worth mentioning amongst manufacturing companies, beyond declines in British Westinghouse preference and Electric Construction shares.

The British Electric Traction resolutions for writing down the capital of the company, and its re-arrangement into two classes of stock, were duly passed at the meeting last week. Business has been taking place in the 7 per cent. preference on the basis of 37½, and in the 6 per cent. preferred at about 10¼, while the 5 per cent. perpetual debenture stock is rather better at 78¾.

Some astonishment is aroused at the action of the Adelaide Electric Supply Co. in asking debenture-holders to consent to a variation which apparently removes the date of the redemption of the stock at 105 from 1936 to about 15 years later. It is difficult to believe that the board can intend to suggest such a course, and perhaps there is a misunderstanding which will be removed by subsequent developments. Meanwhile, stockholders will do well not to send in their proxies until all ambiguity is cleared away.

The Telegraph market is flat, weakness extending from the Anglo-American group to that of the Far East, and embracing the shares of the trust companies. Disinclination on the part of buyers, and a pressing desire to sell on the part of a few executors of deceased accounts, have combined to lower the market. The table of yields which we give in our share list is worth consideration by those who have money left over from the War Loan, for the cable industry will be one of the first to revive after the war, and the best companies occupy sound financial positions.

Telegraph Constructions have fallen £1, and other similar descriptions are disposed to give way here and there. In sharp contrast to this depression in the industrial market, there stands out an amazing gamble now going on in New York in the shares of such American commercial companies as are receiving war orders. Some of the prices have been moving by 10 to 20 points a day. The diplomatic situation between America and Germany is wholly ignored, on the confident assumption that the United States will fight its battles in words, and smother its feelings in dollars—dollars mainly of the Allies, of course.

Three stocks stand out in the markets as easy targets for spasms of nervousness whenever dividend-dates draw near, and the trio is composed of Canadian Pacifics, Underground Electric Incomes, and Brazil Tractions. The last-named has been fluctuating sharply because of the regular quarterly fear that the usual 6 per cent. per annum will have to come down. After keeping fairly steady around 50 for some little while, the quotation broke to 48, although Rio exchange remains in the vicinity of 1s. 1d., at which—so it is understood—the company can do quite well on the basis of present earnings. Maybe the dividend will be out before these Notes, but it has been suggested here on several previous occasions that holders of Brazil Tractions might even prefer to see a modest reduction if it were accompanied by assurances that the rate could be maintained with reasonable certainty.

Anglo-Argentine debenture stocks are a dullish market, and the 4½ per cent. issue shed 5 points to 75, bringing it level with the Fives. The Mexican division goes extremely softly. No further news of consequence has arrived to stir up the market, and everybody waits to see whether the promised pacification is going to turn out in the usual manner.

The Marconi meeting produced an intensely interesting speech from the famous and gallant inventor, whose words may well be recommended to those in high official places. In the Stock Exchange the price keeps steady at 36s. 3d. American Marconis touched 14s. 3d., and lost no more than the pence, while Canadians at 4s. 9d. are beginning to rally. The home armament shares show little variation. Rubber is a quiet market, the tendency being to allow prices to slide back slightly.

## SHARE LIST OF ELECTRICAL COMPANIES.

| | Dividend, 1914. | Price July 27, 1915. | Rise or fall this week. | Yield p.c. |
|---|---|---|---|---|
| **HOME ELECTRICITY COMPANIES.** | | | | |
| Brompton Ordinary | 10 | 8 | – ½ | £6 5 0 |
| do. 7 per cent. Pref. | 7 | 7¾ | – | 4 10 4 |
| Charing Cross Ordinary | 5 | 4 | – | 6 5 0 |
| do. do. do. 4½ Pref. | 4½ | 4 | – | 5 12 6 |
| do. do. City Pref. | 4½ | 3⅞ xd | – | 5 16 2 |
| do. 4 Deb. | 4 | 80 | – | 5 0 0 |
| Chelsea | 5 | 4½ | – | 5 11 1 |
| do. 4½ Deb. | 4½ | 88 xd | – | 4 17 10 |
| City of London | 9 | 13 | – ¼ | 6 18 6 |
| do. do. 6 per cent. Pref. | 6 | 11 | – ½ | 5 9 1 |
| do. do. 5 Deb. | 5 | 100 | –5 | 5 0 0 |
| do. do. 4½ Deb. | 4½ | 85 | –5 | 5 6 0 |
| County of London | 7 | 10½ | – ½ | 6 13 4 |
| do. do. 6 per cent. Pref. | 6 | 10⅝ | – ⅛ | 5 14 3 |
| do. do. 1st Deb. | 4½ | 90 | –6 | 5 0 0 |
| do. do. 2nd Deb. | 4½ | 85 | –5 | 5 6 0 |
| Kensington Ordinary | 9 | 6½ | – ½ | 6 18 6 |
| London Electric | 4 | 1⅝ | – | 8 8 4 |
| do. do. 6 per cent. Pref. | 6 | 4¾ | – ¼ | 6 6 4 |
| do. do. 4 Deb. | 4 | 80 | – 2 | 5 0 0 |
| Metropolitan | 8½ | 8 | – | 5 16 8 |
| do. 4½ per cent. Pref. | 4½ | 3⅞ | – | 6 0 0 |
| do. 4½ Deb. | 4½ | 90 | – | 5 0 0 |
| do. 3½ Deb. | 3½ | 70 | – | 5 0 0 |
| St. James' and Pall Mall | 10 | 7 | – | 7 0 0 |
| do. do. do. 7 per cent. Pref. | 7 | 6½ | – | 5 12 0 |
| do. do. do. 5½ Deb. | 5½ | 70 xd | – | 5 0 0 |
| South London | 5 | 3 | – | 6 13 4 |
| South Metropolitan Pref. | 7 | 1⅛ | – | 6 4 5 |
| Westminster Ordinary | 9 | 7 | – | 6 8 7 |
| do. 4½ Pref. | 4½ | 4⅛ | – | 4 17 4 |
| **TELEGRAPHS AND TELEPHONES.** | | | | |
| Anglo-Am. Tel. Pref. | 6 | 98 | –2 | 6 2 6 |
| do. Def. | 1½ | 21¼ | – ¼ | 7 1 2 |
| Chile Telephone | 8 | 6⅝ | – | 5 18 5 |
| Cuba Sub. Ord. | 5 | 8¼ | – | 6 1 8 |
| do. Pref. | 10 | 15 | – | 6 13 4 |
| Eastern Extension | 7 | 11½ | – | *6 19 0 |
| do. 4 Deb. | 4 | 80 | –2½ | 5 0 0 |
| Eastern Tel. Ord. | 7 | 121 | – | *6 12 2 |
| do. 3½ Pref. | 3½ | 70 | –1 | 5 0 0 |
| do. 4 Deb. | 4 | 80 | –1 | 5 0 0 |
| Globe Tel. and T. Ord. | 6 | 9⅞ | – ¼ | *7 0 8 |
| do. Pref. | 6 | 11 | – ½ | 5 9 1 |
| Gt. Northern Tel. | 22 | 33 | –1 | 6 13 4 |
| Indo-European | 65/- | 52 | – | 6 5 0 |
| Marconi | 10 | 1 13/16 | – | 6 3 1 |
| New York Tel. 4½ | 4½ | 96 | +1 | 4 13 9 |
| Oriental Telephone Ord. | 10 | 17/8 | – | 5 6 8 |
| do. Pref. | 6 | 1⅛ | – 1/16 | 5 6 8 |
| Tel. Egypt Deb. | 4½ | 88 | – | 5 2 8 |
| United R. Plate Tel. | 8 | 5⅞ | – | *7 19 10 |
| do. Pref. | 5 | 4 | – | 5 2 7 |
| West India and Pan. | 1 | 1⅛ | – | 8 17 9 |
| Western Telegraph | 7 | 11¾ | – ⅛ | *6 16 2 |
| do. 4 Deb. | 4 | 81 | –1 | 4 16 5 |
| **HOME RAILS.** | | | | |
| Central London, Ord. Assented | 4 | 74 | +1 | 5 8 1 |
| Metropolitan | 1½ | 24½ | – ½ | 5 2 0 |
| do. District | Nil | 18 | – ½ | Nil |
| Underground Electric Ordinary | Nil | 1⅜ | – | Nil |
| do. do. "A" | Nil | 6/- | – | Nil |
| do. do. Income | 6 | 75 | – | *9 8 0 |
| **FOREIGN TRAMS, &c.** | | | | |
| Anglo-Arg. Trams, First Pref. | 5½ | 4xd | – | 6 17 6 |
| do. 2nd Pref. | 5½ | 8½ xd | – | 7 17 2 |
| do. 4 Deb. | 4 | 75 xd | – | 5 6 8 |
| do. 4½ Deb. | 4½ | 75 xd | –5 | 6 0 0 |
| do. 5 Deb. | 5 | 75 | – | 6 13 4 |
| Brazil Tractions | 6 | 48 | –1½ | 12 10 0 |
| Bombay Electric Pref. | 6 | 10½ | – | 5 16 10 |
| do. 4½ Deb. | 4½ | 90 | – | 5 0 0 |
| Mexico Trams | Nil | 33 | – | Nil |
| do. 5 per cent. Bonds | — | 50 | – | Nil |
| do. 6 per cent. Bonds | — | 80 | – | Nil |
| Mexican Light Common | Nil | 20 | – | Nil |
| do. Pref. | Nil | 30 | – | Nil |
| do. 1st Bonds | — | 45 | – | — |
| Adelaide Sup. 6 per cent. Pref. | 6 | 5 | – | 6 0 0 |
| do. 5 Deb. | 5 | 99 | – | 5 1 0 |
| **MANUFACTURING COMPANIES.** | | | | |
| Babcock & Wilcox | 14 | 2½ | – | 6 4 5 |
| British Aluminium Ord. | 5 | 1⅞ | – | 4 14 1 |
| do. Pref. | 6 | 18/3 | – | 6 9 9 |
| British Insulated Ord. | 15 | 11 | – | 6 13 4 |
| do. Pref. | 6 | 6 | – | 5 0 0 |
| British Westinghouse Pref. | 7½ | 33/6 | –1/6 | 8 19 2 |
| do. 4 Deb. | 4 | 70 xd | – | 5 14 4 |
| do. 6 p. lien | 6 | 100 | – | 6 0 0 |
| Callenders | 15 | 11 | – ¼ | 6 16 4 |
| do. 5 Pref. | 5 | 4⅞ | – | 5 2 7 |
| do. 4½ Deb. | 4½ | 95 | – | 4 14 9 |
| Castner-Kellner | 15 | 8½ | – | 4 12 6 |
| Edison & Swan, £3 pd. | Nil | 11/6 | – | Nil |
| do. do. fully paid | Nil | 1 | – ¼ | Nil |
| do. do. 4 Deb. | 4 | 60 xd | – | 6 13 4 |
| do. do. 5 % Deb. | 5 | 60 | – | 8 6 8 |
| Electric Construction | 6 | 11/6 | –1/- | 10 8 8 |
| do. do. Pref. | 7 | 1 xd | – | 7 0 0 |
| Gen. Elec. Pref. | 6 | 9⅜ xd | – | 6 3 1 |
| Henley | 20 | 14 | – | *8 3 3 |
| do. 4½ Pref. | 4½ | 4⅜ | – | 4 14 9 |
| do. 4½ Deb. | 4½ | 95 | – | 4 14 9 |
| India-Rubber | 5 | 8¾ | – | 5 14 3 |
| Telegraph Con. | 20 | 32 | –1 | 7 7 6 |

* Allowance made for dividends being paid free of income-tax.

**Underground Electric Railways Co. of London, Ltd.**—Interest on the 6 per cent. first cumulative income debenture stock will be paid on and after September 1st, less income-tax, at the rate of 6 per cent. per annum, and coupon No. 15 of the 6 per cent. income bonds will be paid, free of British income-tax, at the rate of 6 per cent. per annum on the same date.

## REVIEWS.

*Electricity in Mining.* By D. R. SHEARER. London: Hill Publishing Co. Price 6s. 3d. net.

This is an American publication intended to fulfil, so we are told in the preface, "a demand for a small treatise covering in a general way the many phases of electrical engineering as applied to coal mining," and to "be of use to the investor or the operator in outlining methods of procedure and to the operating engineer in tracing the foundations upon which an electrical power plant may be established and operated in the most efficient manner." The book is divided into 13 short chapters, which deal with the subject, technically speaking, in a very elementary manner and give a minimum of information, but much good advice. For instance, in Chapter V, on the "Selection of Power Plant Equipment," the main point which the author tries to drive home is that an engineer should be employed to design the plant, and much that he says is sound common sense. Evidently conditions in American mines relating to electrical engineering are very similar to those existing in this country previously to the introduction of the last Home Office special rules, for in Chapter I we read "It is a lamentable fact that few mine operators (managers) give to their electrical plant the attention justly due, either as to its layout and equipment or to its operation and upkeep. Frequently in their efforts to secure economy in power plant costs the owners install inadequate machinery in an improper or incomplete manner, and place this equipment in the care of men limited in both training and experience." Again, in the last chapter, dealing with efficient operation, we read: "The trouble with a great many mine superintendents and their electricians is that they have an idea that it is economy to run any machine as long as a wheel will turn, regardless of conditions or the state in which the machine is operating. The writer has seen a motor taken in on a haul when there was almost a certainty that it would burn out on the first heavy pull. This it did, although a half-hour's repair work on one of the coils before it entered the mine would have saved a complete re-winding, several days' labour, and the loss of the use of the machine."

The author apparently is not very favourable to "salesmen," as "too often a manager or superintendent is induced to purchase certain machines by some smooth-tongued salesman who, of course, knows his own line better than any other, and naturally believes it to be the best, regardless of conditions to be met or previous operating experiences with the same machine," and "the supply salesmen are not going to assist the plant toward economical operation, for they wish to sell more supplies," which is true to some extent, but we must not forget that the chief object of the salesman is to obtain a permanent customer for his firm, or to increase the firm's reputation by a recommendation from one customer to another, and to sell unsatisfactory machines or material is undoubtedly the wrong way to do this.

The work is well printed and nicely bound, and the illustrations consist of a few diagrams and photographic views. As already mentioned, the book is not intended as a technical exposition on mining electrical engineering, and therefore too much must not be expected of it; what is dealt with is more in accordance with American than British practice. Electrical haulage, for instance, is confined to "locomotive" haulage, and the coal-cutting machinery described is totally unsuited to the conditions of machine mining in this country.

In spite, however, of its limitations in this respect, we can recommend it as a work full of common sense and sound advice on the question of installing and operating electricity in mines, and one that should be read by all interested either financially or in the management of mines, especially those who are considering the installation of electricity.

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*Electric Light Fitting.* By S. C. BATSTONE. London: Whittaker & Co. Price 5s. net.

It is no easy task, if one may judge by most text-books on electric wiring, to write a book on the subject which covers the ground sufficiently well, and yet avoids many sections of electrical engineering which are not directly concerned with wiring. Mr. Batstone has been decidedly successful in his book in this respect. He gives a brief but sufficiently complete explanation of electrical terms and of the theory of electricity, using the analogy of the flow of water in pipes with great effect, and then proceeds at once to discuss wiring systems and all the various "accessories" used in connection therewith. This section of the book is copiously illustrated. If there is a fault in that direction, it is that there are too many illustrations, as anyone using the book might be assumed to be familiar with the external appearances of ceiling roses, tumbler switches, metal-filament lamps, and so on. It is, however, a fault on the right side.

In the chapter on wiring systems some suggestions as to the conditions suitable for each system might, with advantage, be added in a future edition.

Following the descriptions and illustrations of accessories comes a chapter on "Transformers, arrangement of Circuits and methods of Wiring." It is doubtful whether Mr. Batstone's implied recommendation to use small transformers would be considered good practice to-day, as high-voltage metallic-filament lamps are now cheap and reliable. It is in reading this chapter that one grudges the space wasted on some unnecessary illustrations of accessories. One would have liked to have had "arrangement of circuits" treated much more fully, with a typical circuit shown wired in various ways to illustrate the opportunities of waste or economy of material that result. This highly important question for the wireman is not mentioned, although the man laying out the circuits has no more important problem.

The remainder of the book deals with the erection of fittings, meters, private plants and supply stations, followed by the apparently inevitable reprint of the I.E.E. Rules and Home Office Regulations. All these subjects are carefully dealt with and well illustrated, though the plans of the private plant general arrangements would be improved by giving the approximate scale to which they have been drawn. They all show, too, the battery arranged in double tiers, which is decidedly undesirable, if it can possibly be avoided.

There are a few further points which might receive attention in a future edition. The remarks as to the use of aluminium as a conductor are rather too sweeping, unless it is made more clear that only internal wiring work is referred to, whilst the table for the ratings of various conductors would be improved by substituting the I.E.E. ratings as the "safe" currents in place of the ratings at 1,000 amperes per sq. in. One of the very few sections of the book in which all details are not very clearly explained is that dealing with the calculations for water power, and a re-drafting of this portion would be advantageous. The use of charge battery meters reading 10 per cent. slow is by no means satisfactory (it gives no means of recording properly the occasional overcharge that is necessary), and it is a pity it has been mentioned without criticism. Finally, the size of plant suggested on page 306 is decidedly large. It is rarely necessary to provide the engine and dynamo larger than would be required to run the normal maximum number of lights, but in this example the plant suggested is over twice this size. There is also some mistake in the figures, &c., as printed, which should be corrected.

These faults are of minor importance, however, and are indicated with an eye on the future editions of the book that are sure to be called for. On the whole, it is well and clearly written, and can be recommended with confidence.

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*Konstruktion und Prüfung der Elektrizitätszähler.* By A. KÖNIGSWERTHER. Second Revised Edition. Leipzig: Dr. Max Jähnecke. Price 16 M.

This second edition is a considerable enlargement of the first, and brings the subject of supply meters practically up to date again.

Starting with a consideration of the energy equations for direct and alternating-current circuits, the book proceeds to discuss systematically, and with the aid of good detailed drawings, the construction of practically all the standard types, including recording meters, intermittent registering

meters and integrating meters (electrolytic, clock and motor meters). This section takes up about half the book.

Then follows a section on meters used for special purposes, such as accumulator work, traction work, special tariff meters and prepayment meters.

Some additional information as to certain structural details, such as meter cases, terminals, connecting trains, and bearings, are next given, and, finally, the last section of the book deals comprehensively with the testing of meters and test-room arrangements.

The book is clearly written, and explains the mode of operation of the various meters well and with sufficient of the underlying theory to meet most requirements, so that it should prove of great use to those responsible for the inspection and maintenance of electricity meters of any and every type.

## THE CENTRAL POWER STATION OF THE RANDFONTEIN ESTATES.

By R. TURNBULL MAWDESLEY.

(*Concluded from page* 102.)

Regarding the application of power, the principal reduction works, which has the distinction of being the largest of its kind in the world, gives a constant load throughout the 24 hours of the day, of about 4,000 kw. The sub-station supplying these works is of 6,000-kw. capacity, and is situated at the west end of the mill. The transformation ratio is 6,600/550, and the current is distributed by 36 ·2-in. three-core paper-insulated cables. The battery motors are in 100-h.p. units, running at 480 r.p.m., and are all of the short-circuited type, the full-load slip being 3 per cent. They are started up with compensators with taps giving 50, 70 and 80 per cent. of the normal pressure. The total number of motors used at the reduction works is 150.

The mine drainage pumps are of two capacities, 12,000 gallons and 6,000 gallons per hour. Current is taken down the shafts at 2,000 volts and transformed to 120 volts at the pumping stations. The pumps are mostly of the horizontal type, running at 40 r.p.m., and either driven by belts or through gearing.

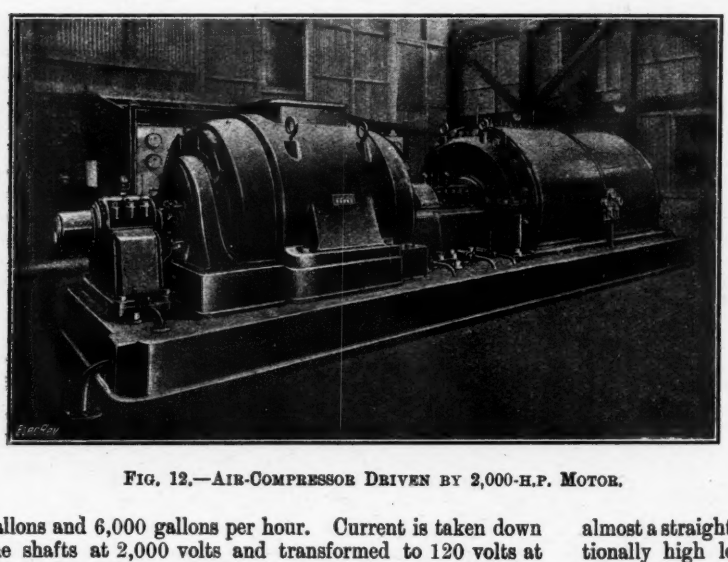


Fig. 12.—Air-Compressor Driven by 2,000-h.p. Motor.

There are six air compressors at present in operation, five being of the reciprocating type, and one being a turbo-compressor driven by a 2,000-h.p. synchronous motor (see fig. 12). This last compressor, together with one of the reciprocating compressors driven by an 800-h.p. induction motor, is situated at the "south" shaft. The larger motor runs at 3,000 r.p.m., and is started up by means of a special starting converter, which consists of a small induction motor driving a three-phase generator. This three-phase generator, as well as the 2,000-h.p. synchronous motor, is separately excited by a small induction motor-generator. The small three-phase generator is fully excited before starting, and the main leads are coupled direct to the stator windings of the synchronous motor. Then the induction motor is started by means of a liquid resistance. When the 2,000-h.p. synchronous motor is up to speed, it is paralleled with the line by an ordinary synchroscope, and the starting set is shut down.

Four of the 800-h.p. motors driving the reciprocating compressors are of the synchronous type, and are started up by means of 100 h.p. induction motors through clutches, the excitation current in each case being supplied by a small induction motor-generator.

Fourteen direct-current hoists of the Ward-Leonard type have been installed on the surface, and eight three-phase second-stage hoists below ground. The general appearance of the Ward-Leonard hoist is shown in fig. 13.

The Ward-Leonard hoists are each operated by two six-pole d.c. motors provided with commutating poles and connected to the drum shaft. These motors each have a continuous rating of 350 h.p., and an intermittent rating of 700 h.p., thus giving a total of 1,400 b.h.p. per hoist at the peak loads. Direct current for each hoist is supplied from a converter set driven by a three-phase induction motor, having a normal rating of 800 h.p., and a maximum of 1,700 h.p., the breakdown torque being 2·5 times the normal, and the speed being 485 r.p.m.

The d.c. generator is provided with compensating windings, the normal rating being 670 kw., and the maximum 1,400 kw. The exciting generator is compound-wound and is mounted on an extension of the converter shaft. It furnishes current at 220 volts, and supplies the d.c. generator fields, the hoist motor fields, and the brake-magnets.

The hoist controller is of the commutator type, and as it only handles the excitation current, it is not very massive.

Automatic acceleration and retardation of the hoists is provided for by interconnecting the controller lever mechanically with the depth indicator, which is of the pillar type.

The winding drums are cylindrical, 10 ft. in diameter × 4 ft. wide. Both drums are loose on the shaft, and are driven by multi-tooth jaw clutches sliding on polygonal seatings.

The brakes are of the post type, released by compressed air, the braking being performed by a dead weight. The air supply is from the ordinary compressed-air mains, but an auxiliary compressor is installed, which starts up automatically when the mine compressed-air pressure falls below normal. There is also a magnetic brake, connected in series with the motor fields. If the power fails, the weight of the falling magnet core opens the exhaust of the brake engine.

The three-phase second-stage hoists offer no special features, the speed variation being obtained by means of resistances inserted in the rotors.

A characteristic station load curve is shown in fig. 14. The peaks at 10 a.m. and 12 noon are slightly abnormal, the general shape of the curve assuming almost a straight line on an ordinary week-day. The exceptionally high load factor which the Randfontein Estates power station enjoys must be, for an isolated station, almost a record. Of course, with several stations operating in parallel, it is possible to adjust the output and load factor of any particular station as desired, but in the case of one station supplying the total power, the load factor is, *ipso facto*, beyond the control of the operating staff; for this reason, the load curve at Randfontein must almost stand alone.

The average power factor is about ·85, and can be adjusted within limits by the excitation of the synchronous compressor-motors. It will be observed that although the whole of the Estate buildings, shafts, workshops, mills, &c., are illuminated electrically from the power station, the lighting load has no appreciable effect on the load curve.

A portion only of the Reduction Works load curve is shown—sufficient only to demonstrate its constancy. On Sundays and "clean-up" days this load falls off, and this is the only period in which it is necessary to take off boilers from the range, the same number of boilers remaining on the range from Monday morning to Sunday morning. Regarding the capacity of the station, there is, comparatively speaking, little changing-over to be done—except at week-ends; and the switching operations, although of necessity calling for highly-skilled operators, are very few compared with, say, a lighting station at home of the same capacity.

The station, as it stands to-day, has the largest installed capacity of any in the British Empire, *i.e.*, taking plants generating current for private use for industrial purposes, and not selling power in bulk or otherwise. The high load factor is, of course, chiefly responsible for the low cost of production, and this cost would be considerably reduced were the power station nearer to the coal supply. The cost of condensing is another item, which would be eliminated could the station have been erected near a river or mine dam.

The station site was chosen by Mr. Butt in 1907, and was determined by the centre of gravity of the load to be expected. No other consideration could influence the selection of a site, since no coal mine, river or lake existed within such distance as could affect this point.

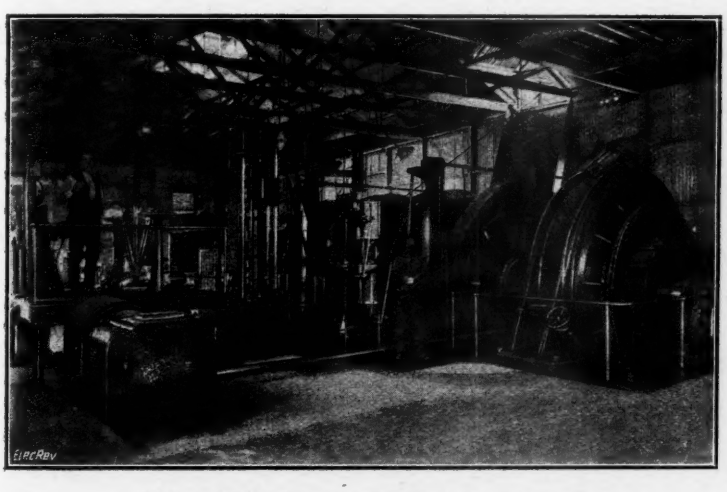


FIG. 13.—WARD LEONARD HOIST AT NO. 8 SHAFT.

The whole of the power station plant, as well as all electrical equipment outside on the mines, has been laid down to the design and specification of Mr. T. P. E. Butt, the consulting engineer for the Randfontein Estates and Associated Companies, on all matters appertaining to the generation and application of electric power. The writer's thanks are due to Mr. Butt for permission to publish these details, and also for facilities granted in connection with the views, which were taken by Mr. G. A. Watson.

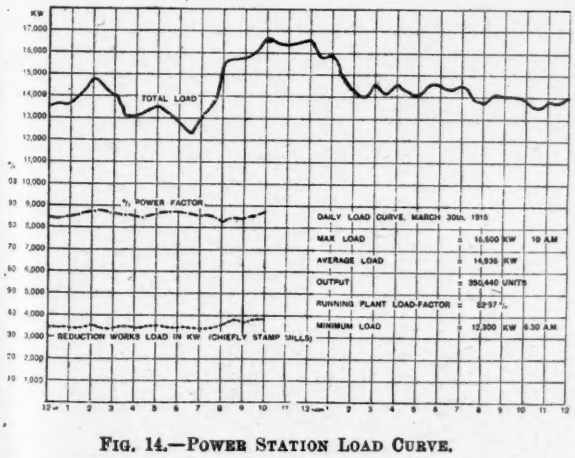

KW
TOTAL LOAD
% POWER FACTOR
DAILY LOAD CURVE, MARCH 30th, 1915
MAX LOAD = 16,500 KW 10 A.M.
AVERAGE LOAD = 14,935 KW
OUTPUT = 350,440 UNITS
RUNNING PLANT LOAD-FACTOR = 82·97 %
MINIMUM LOAD = 12,300 KW 6.30 A.M.
REDUCTION WORKS LOAD IN KW (CHIEFLY STAMP MILLS)

FIG. 14.—POWER STATION LOAD CURVE.

The general information on the power station is from the writer's personal association with the plant, but the writer also desires to acknowledge as a source of information, particularly regarding the distribution and application of power, a paper read by Mr. Butt before the South African Institute of Engineers in May, 1911. In this paper—"The Electrification of the Randfontein Central"—Mr. Butt described the plant at that time installed, and exhibited a wealth of detail and data altogether beyond the scope of this article.

## A SIMPLE RADIOGRAPHIC METHOD FOR LOCALISING BULLETS.

BY L. CROUCH.

USEFUL as radiography is in times of peace, it is simply invaluable in time of war, and X-ray apparatus forms part of the standard equipment of every military hospital of any importance. By far the most frequent application of the rays is to the precise localisation of bullets and shrapnel fragments, &c. The almost complete opacity of the latter permits a sharp image to be obtained easily and quickly, and, under present conditions, unhappily, speed is a consideration second only to that of reliability.

Before the Académie des Sciences, Dr. E. Colardeau described recently a simple and exact method of radiographic localisation which has been used successfully in several French hospitals, notably in the military hospital at Trouville. This method possesses the very desirable, if not indispensable, attribute that only the simplest accessory apparatus is required, over and above the standard radiographic equipment. By additions which can be "home made," or, what is more important, made in the field, the most modest X-ray equipment can be converted into a precision installation.

To determine completely the position of the projectile in a wounded person is a problem in elementary solid geometry. If we mark on the surface of the flesh (near the point where we have reason to suppose the projectile is to be found) a small cross defining a point O, which we take to be the origin of a system of three rectangular co-ordinates (axes running $x$—right and left; $y$—head and foot; and $z$—front and back), we have only to determine the co-ordinates (X, Y, Z) of the projectile with reference to these axes, in order to know just where to operate for its removal.

Two consecutive radiographic exposures are necessary and sufficient to give the desired information. Referring to fig. 1, C represents a section of that part of the body (thorax or leg, for instance) in which is a projectile P. The photographic plate S is placed in a slide B (fig. 2) and can be replaced by a second plate without requiring the patient or the slide to be moved. In the cover of the slide are four small nails, $x$, $x^1$, $y$, $y^1$, set on two (imaginary) lines at right angles; these nails are printed, together

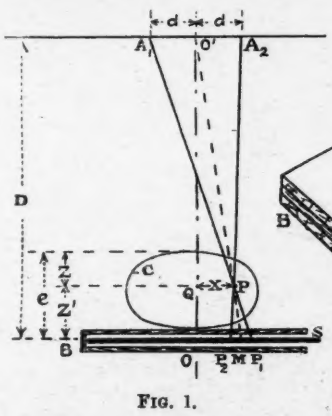



FIG. 1.

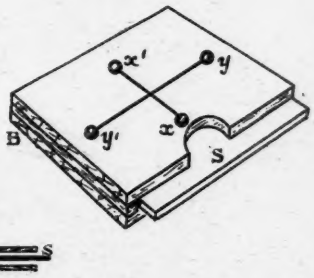



FIG. 2.

with the bullet and bones, &c., on the negative, and permit axes $x$, $x^1$, $y$, $y^1$ to be drawn on the latter, intersecting at the centre O of the plate.

The exposure box is placed beneath the X-ray tube, with its sensitive surface 50 cm. from the point of emission. A plumb-line is used to get the centre point O in the vertical through the point of emission, this vertical being the axis of Z in the system of reference co-ordinates. This preliminary adjustment of the plate takes

but a few seconds, and the patient is then so disposed that the region where the bullet is supposed to be is approximately centred over the plate. A small gummed label, previously placed at the point O on the exposure box, adheres to the patient's body, and thus marks on it one datum point from which measurements, determined as below, are to be made. A second point on the Z-axis is obtained from the plumb line already mentioned; this is adjusted to graze the patient's flesh, and the point of contact is marked in dermographic crayon by two lines running in the directions $x\,x^1$, $y\,y^1$ of the exposure box axes.

Two exposures are now made with the emission point of the X-ray tube displaced a distance $d$ to right and left respectively of the centre point $O^1$ along the axis $x\,x^1$ (fig. 1). Images $P_1$ $P_2$ of the projectile are thus obtained on two plates, corresponding to settings $A_1$ $A_2$ of the X-ray tube. It is, of course, important that the patient should not move during the short period required to make the two exposures after the preliminary adjustments are completed.

The two negatives obtained show the projectile in different positions with regard to the reference points $x\,x^1$, $y\,y^1$ (fig. 3), and if the distance $2d$ (fig. 1) between the points $A_1$ $A_2$ be made 64 mm. (ca. 2½ in.), *i.e.*, the mean distance between the eyes, one can

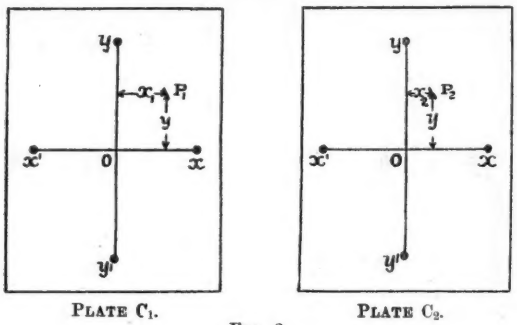



PLATE $C_1$. PLATE $C_2$.

FIG. 3.

observe the two plates in a stereoscope in exact relief, which is often convenient. The axes $x\,x^1$, $y\,y^1$ being pencilled on the negatives, one measures:—The distance $x_1$ of $P_1$ from $y\,y^1$ on plate $C_1$; the distance $x_2$ of $P_2$ from $y\,y^1$ on $C_2$; and the distance $y$ of $P_1$ or $P_2$ from $x\,x^1$ on either plate. Then in the two similar triangles $A_1$ P $A_2$; $P_1$ P $P_2$ fig. 1:—$z^1/(D\text{-}z^1) = (x_2 - x_1)/2d$, whence—

$$z^1 = \frac{D\,(x_2 - x_1)}{(x_2 - x_1) + 2d},$$

and, if D = 500 mm. and $2d$ = 64 mm.: $z^1 = 500\,(x_2 - x_1)/(x_2 - x_1 + 64)$ If it is more convenient to know the depth Z of P measured from the point marked by the plumb-bob, it is only necessary to measure the thickness $e$ between the datum points; then: $Z = e - z^1$.

Again, in the similar triangles, $O^1$ Q P, $O^1$ O M, fig 1:—

$$X/\frac{x_1 + x_2}{2} = (D - z^1)/D, \text{ whence}$$

$$X = \frac{(500 - z^1)\,(x_1 + x_2)}{1{,}000} \text{ mm.}$$

and similarly, $Y = (500 - z^1)\,y/500$ mm. Knowing the co-ordinates X, Y, they are "plotted" on the patient's body from the origin O, and the point (X, Y) thus obtained is marked clearly by, say, a cross in a circle, and a note is made alongside as to the depth (Z) at which the projectile will be found beneath this point. To prevent accidents, the "origin" O is effaced, and the patient is then ready to go before the operating surgeon.

Using a ready-reckoner, which can easily be compiled from the above formulæ, using the particular values of D and $A_1$ $A_2$ which are found most convenient, the surgeon can operate within five minutes or less of the time of making the radiographic exposures and with the certainty that he will recover the bullet quickly and with minimum pain and injury to the patient.

## ON AN UNBROKEN ALTERNATING CURRENT FOR CABLE TELEGRAPHY.

By LIEUT.-COLONEL GEORGE O. SQUIER, PH.D.

(*Abstract of Paper read before* THE PHYSICAL SOCIETY OF LONDON, *June 25th*, 1915.)

THE object of this paper is to propose a new angle of view in the method of transmission of signals in the submarine telegraph cable, and to describe some apparatus for operating on the general principles involved.

Experiments have been conducted during the past two years at the works of Messrs. Muirhead & Co., Ltd., with a view to determining the practical application of the sine-wave type of E.M.F. for cable signalling. The results thus far obtained have only been made possible through the wide range of experience and practice which this distinguished firm of cable engineers have been able to bring to bear on the subject, and they have taken a leading part throughout the experiments that have been carried out.

Sixteen years ago Dr. Crehore and the author conducted some experiments on an Atlantic cable from Waterville, Ireland, to Nova Scotia, Canada, using a special form of dynamo as a source of power for operating the cable.

A transmitter was also devised, in which a special feature was the cutting out or suppressing from the alternating current of certain definite semi-waves of current which enabled the cable code to be transmitted.

At that time the demand for increase of speed over ocean cables was not pressing. In fact, the particular cable used was idle for several hours each day, which fact, however, greatly facilitated the opportunities for experimenting. Wireless telegraphy did not then exist, and the cable relay or amplifier had not appeared, so that very accurate balancing of the duplex bridge was not required.

Conditions have changed materially since 1899, until at the present moment it may be said that the matter of obtaining increased speed on ocean cables with present apparatus is largely controlled by the accuracy with which the duplex-bridge may be balanced.

If an engineer were required to design a system for operating an electric motor through an Atlantic cable, no form of generator could be proposed at present other than a single-phase alternating current of the sine-wave type. This form, we know, will deliver power at the receiving end of the cable more efficiently than any other shape of wave. Furthermore, during the operation of such a motor, the generator would be allowed to run smoothly and regularly, and, in particular, the generator circuit would never be metallically opened or closed during operation. The opening and closing of an alternating-current circuit is well known to produce disturbances of a more or less pronounced character, depending upon the angle of phase at which the current is opened or closed.

Since improvement of the duplex-bridge balance, as stated above, is really at present a most important desideratum, experiments were made using the Muirhead artificial cable to compare the present forms of battery transmitters with various modifications of the sine wave of E.M.F.

In the last analysis it was always the opening and closing of the transmitter circuit which produced the final kick or "jar" in the balance. This is not surprising when we remember that, from an electrical standpoint, few things can be done to a circuit more severe than suddenly to introduce an infinite resistance into it.

It was only after many variations of the simple alternating current had been tried in the course of experiments to perfect the duplex-balance of the bridge that the fundamental principle of never breaking the transmitter circuit became impressed.

Continuing the analogy of the power plant, it may be remarked that practically every form of cable recorder, amplifier or relay is essentially an alternating-current motor. Its field magnets, armature coil, and the counter E.M.F. of damping are subject to the same laws as in the motor for power purposes.

Let us assume, therefore, as a starting point, the standard type of circuit for operating a cable simply as a power plant as the ideal solution of the problem, and then determine by experiment how near this solution may be retained in practice for the purpose of transmitting cable signals according to the present alphabet. In this plan it will be the continued experimental purpose to determine the minimum possible variations in such a system to enable the alternating current received to be interpreted into dots, dashes and spaces.

A siphon recorder placed in the receiving end of such a cable plant would trace on the recording slip an uninterrupted sine-wave

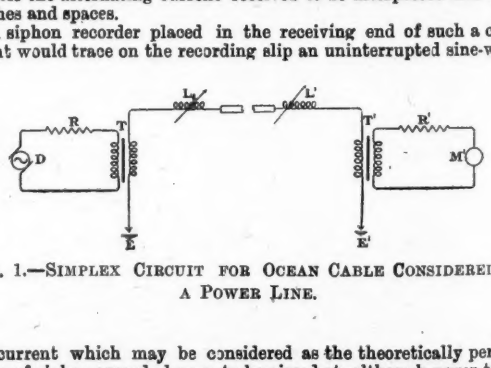



FIG. 1.—SIMPLEX CIRCUIT FOR OCEAN CABLE CONSIDERED AS A POWER LINE.

of current which may be considered as the theoretically perfect form of siphon record always to be aimed at, although never to be actually attained in practical telegraphy.

In fig. 1, D represents a single-phase alternating-current dynamo, R and R′ are resistances and M′ is a motor to be operated.

Since a circuit comprising an ocean cable is largely overloaded with capacity, and already includes a large ohmic resistance, it will be in the direction of increasing the resultant harmonic current flowing in such a circuit, to insert in the sending end of the cable a variable inductance, $L_1$. For symmetry, L′ is a variable inductance similar to $L_1$.

T and T′ are iron-cored transformers or auto-transformers, the coils of which are of low resistance, and connected directly to the earth at E and E′.

The circuits in fig. 1 are closed circuits throughout.

For duplex working fig. 1 becomes fig. 2, in which $L_1$, $L_2$, $L_3$, $L_4$ are the inductance arms of the bridge, and the motors M and M′ are inserted in the usual manner for cable working; $A_1$ and $A_1'$ are the artificial lines.

It now remains to inquire as to what modifications must be made

in the typical duplex power circuit in fig. 2 to enable the motor recorders to indicate the elements of the cable alphabet. These elements are three in number, and only three—*i.e.*, the dot, the dash and the space—and each of them is equally important in interpreting the record, and for this reason they will each be considered in the general sense as signal units, rather than the usual way of regarding only the dots and dashes as the signals, and not the spaces.

It is also usual to speak of cable speeds in terms of standard letters per minute transmitted; but for our present purposes it

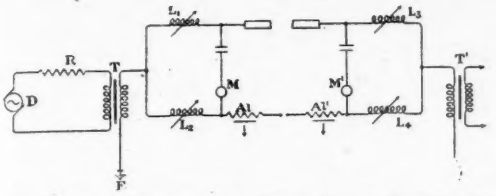
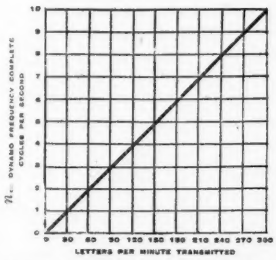



Fig. 2.—Duplex Circuit for Ocean Cable Considered as a Power Line.

will be more convenient to convert this speed into terms of the frequency of the dynamo. The graph (fig. 3) exhibits the linear relation between $n$, the frequency of the dynamo, and letters per minute transmitted, based on the assumption that the average cable letter, with its space, requires four units of alphabet time.

Careful experiments on an Atlantic cable confirm the theory of the subject—that, no matter what the shape of the alternating




4 signals = average letter with its space,
$n$ = dynamo frequency in complete cycles per second.

Fig. 3.—Speed of Cable Signalling in Letters per Minute in Terms of the Frequency of the Alternator.

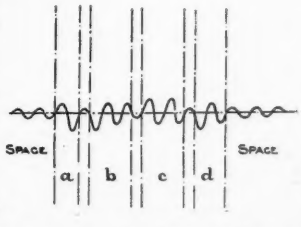



Fig. 4.—Current Waves for Transmitting the Letters *a*, *b*, *c* and *d* by the Alternating Current.

current transmitted, approximate sine waves are received at the distant end of the cable. Battery reversals produce just as accurate sine-wave signals on the receiving recorder as does the alternator itself. In other words, it is the fundamental term of the Fourier analysis which is alone concerned in making the record at the receiving end of the cable.

Since, therefore, both theory and experiment show that a sine form of wave is the only one which can pass through the cable without changing its characteristic shape, it should be an advantage so to alter the typical power circuit in fig. 2 as to preserve the sine characteristic as far as possible.

This can be done in a simple manner by operating upon the primary circuit of the transmitter containing the generator, to alter the impedance of the circuit in synchronism with the generator itself. The problem is the more simple from the practical standpoint, because we are dealing with frequencies from about 4 to 10 cycles per second, and, therefore, it is easy to operate with great accuracy on this primary current at any angle of phase. If the change of impedance of the primary circuit always takes place at the instants when the current flowing in the circuit is naturally zero, the fundamental frequency of the current will not be changed, and the sine characteristic of the wave will be very approximately maintained. Varying the impedance of the primary circuit will change the amplitude of the individual alternations of the current.

Another way of stating the effect is that the voltage between the end of the cable and the earth is made to vary by this process, to indicate the three elements of the cable alphabet. It should be noted that this plan transmits alternating current for the spaces between letters and words with exactly the same regularity and integrity as for the signals themselves.

Dots, dashes and spaces are each transmitted by impulses of either sign, differing from each other only in amplitude.

Fig. 4 shows diagrammatically the form of current waves transmitted for the letters *a*, *b*, *c*, and *d*, with the accompanying spaces required.

Although an alternating current operated upon as above outlined could be read directly from a standard siphon record, yet it would be considered an advantage if the final received record could be printed in Morse characters on the usual receiver slip. To accomplish this it will be necessary to provide an apparatus which operates solely by the amplitude of the current waves received, and not by their sign. Furthermore, since the impulses transmitted and received for the spaces are not required on the printed slip, the apparatus should be capable of sorting out and omitting these parts of the record automatically.

Fig. 5 shows diagrammatically one form of circuit arrangement based on the above principles for transmitting and receiving messages. The usual transmitting condensers are shown in the arms of the duplex bridge, instead of the inductances $L_1$, $L_2$, $L_3$, $L_4$. The ordinary transmitting tape is caused to move synchronously with the generator by being geared directly to its armature shaft. The perforations in the tape are of such a size that the tape advances a distance corresponding to one semi-cycle of the alternator for each individual perforation.

Since in a circuit comprising an ocean cable on which is impressed an alternating E.M.F. the current leads the E.M.F. by an angle, which in an infinite cable is constant at 45°, it is necessary to provide in the transmitter, mechanism for moving the tape carriage longitudinally relative to the perforations in the tape. A micrometer screw is provided for this purpose, and by its use the

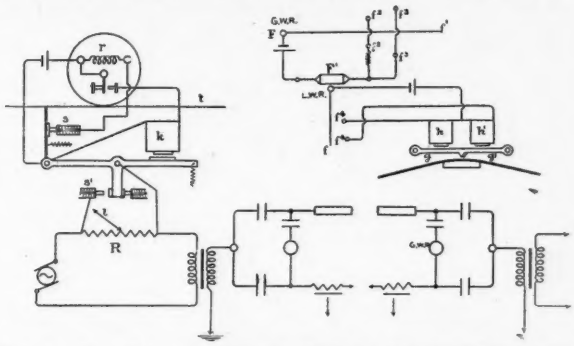



Fig. 5.—One Form of Duplex Circuit Arrangement for Transmitting and Receiving Messages by the Alternating Current.

current can be operated upon accurately at any angle of its phase in practice it is so adjusted that the impedance of the primary circuit will be changed at the instants of zero phase of the current. Since also the angle by which the current leads the E.M.F. is dependent upon the resistance of the primary circuit, there is provided in addition an adjustment of the transmitter for the very slight difference of phase for the dot-and-dash conditions, so that in effect all operations on the primary current, whether for a dot, dash or space, are adjusted to take place at the zero point of current.

The general operation of the transmitter mechanism is as follows: When no holes are perforated in the tape $t$, the whole resistance R is in the primary circuit and an alternating current is transmitted, which corresponds to spaces between letters and words; when a perforation in the tape is on the dot side, part of this resistance R is short-circuited, and when a dash perforation occurs, all of this resistance is short-circuited. The relative values of these resistances being adjustable, the amplitudes of the individual alternations are under complete control by the ordinary transmitting tape.

In the figure is shown diagrammatically the arrangement for causing a dash impulse to be sent by the transmitter by short-circuiting the whole of the resistance R for a time corresponding to one semi-cycle of the alternator. $r$ is an ordinary relay; $k$ is an electromagnet which operates at the end of each signal or group of signals. The line $l$ leads to an exactly similar arrangement which is provided for the dot impulse by which a certain proportion of the resistance R is short-circuited. In practice these two arrangements are side by side, and in the figure the dot arrangement would be immediately behind the one shown for the dash.

The tape carriage can be moved longitudinally by a micrometer screw which is not shown in the figure, and has an adjustment over a range of a complete semi-cycle. The contacts $s$ and $s'$, and similar ones for the dot mechanism, are adjustable by slow-motion screws, so that the instants of contact for a dot and for a dash have an adjustment relatively to each other.

A convenient method of observing the wave-form produced by the transmitter, and for making the above adjustments, is to include an ordinary siphon recorder in the transmitter circuit, or, better, in the cable itself at the transmitting end, by connecting it at the terminals of a very low resistance in the circuit. At the very low frequencies involved, the siphon recorder becomes a most useful and accurate current curve-tracer, and enables the experimenter to observe exactly the shape of wave being transmitted into the cable for any adjustment of the transmitter. Once these adjustments are made for any particular cable they remain unchanged.

One practical arrangement for receiving the signals on a Morse printer is shown diagrammatically in the upper part of the figure. F is an adaptation of the well-known Muirhead gold-wire cable relay, in which $f^1$ is the gold wire which oscillates between the platinum contact posts $f^2f^3$, about a fixed point at F. A second pair of posts $f^2f^2$ is provided, and each of these pairs has an adjustment for altering their distance apart, and also for moving them longitudinally along the gold wire, and relatively to each other. Instead of being separate contacts, as in the usual case

with this relay, each of the pairs are electrically connected, as shown. F′ is a local wire relay of similar principle, and $f$ is its moving part, which in its oscillations makes contact with the posts $f^3f^4$, adjustable, as above; $h$ and $h'$ are electromagnets for operating the dot and dash arms of the printer; $g$ and $g'$ are two arms pivoted at their outer ends, adapted to make a siphon record at their free ends in the centre upon the moving tape shown beneath. The arm $g'$ is forked to record two ink marks on the tape symmetrically on either side of the central mark made by the arm $g$, and in line with it across the tape, so that both arms can make a record simultaneously on the tape for a dash.

The incoming alternating current thus causes the gold wire $f^1$ to oscillate back and forth with different amplitudes depending upon whether dots, dashes or spaces are being received, and the posts $f^2f^2$ are adjusted so that the space amplitude just does *not* make contact, but a dot amplitude of either sign does make contact. In like manner the posts $f^3f^3$ are adjusted so as just *not* to record a dot impulse, but to make contact for the larger amplitude of a dash of either sign. It is seen that both a dot and a dash contact are made whenever a dash amplitude is received. The flexible gold wire $f^1$ in its motions about F first strikes the posts $f^2f^2$, and there is a bending or wrapping effect produced in the wire, which for the stronger dash impulses causes contacts with $f^3f^3$ also. The relay F′ operates similarly through a moving arm, making contact with the posts $f^4f^4$ separately or both together, depending upon the amplitude of its swing.

The printer itself becomes an apparatus of marked simplicity, and is nothing more than two small siphons adapted to mark on the slip in the usual manner.

In practice, all adjustments are so made as to provide for transmitting for the spaces as large an amplitude as possible instead of as small an amplitude as possible, in order to approximate more nearly to the ideal electrical conditions for transmission through the cable itself.

In case a cable magnifier such as the Heurtley instrument is used instead of a gold-wire relay, it would be inserted in fig. 5 in the recorder arm of the bridge, and operate a local wire relay and printer instead of the usual recorder. Since the relay operates on difference of amplitude of the waves, and not on their absolute values, a cable magnifier would serve to exalt the value of this difference and furnish a greater margin for practical working.

*(To be continued.)*

## CALORISING: A PROTECTIVE TREATMENT FOR METAL.

BY H. B. C. ALLISON AND L. A. HAWKINS.

IN connection with the article on "Sheathed-wire Heating Units" printed in our issue of July 9th, the process of "Calorising" was mentioned. The following is an abstract of a description of the process, which appeared in the *General Electric Review* for October, 1914:—

Mr. T. Van Aller has discovered a process of heating metals in revolving drums with mixtures containing, among other things, finely divided aluminium, by which a surface alloy containing aluminium is produced. In the case of copper, this alloy is of the nature of an aluminium bronze, but richer in aluminium than the ordinary alloy of that name and more resistant to heat, so that copper thus treated is protected up to the melting period of the alloy from the scaling which occurs when untreated copper is heated above 300° C. The same general result was obtained in the case of iron and steel. Some use was made of this process, which has been called "Calorising," for treating copper soldering irons and iron resistance wires for heating devices.

Modifications of the process, extending it to further applications, were made by Mr. E. G. Gibson, of the Schenectady Research Laboratory. Pieces which, because of their shape or size, are not adapted for tumbling, may be calorised by packing them in, or painting them with, a suitable mixture, and heating them. Thus, the size of the heater is the only limitation on the size of the piece that may be calorised. Wire or ribbon may be treated by a continuous process, by passing it through a heated pipe containing the proper calorising mixture. There appear to be many places where it is desirable to use iron vessels or apparatus at temperatures above red heat, and at such temperatures ordinary iron rapidly oxidises and scales away. After iron is calorised the effect of heating is slight. Instead of burning and the scale falling off, as in the case of untreated iron, practically no effect can be detected after a considerable time—certainly none which injures the surface. This is well illustrated by the two pieces of iron pipe shown in fig. 1, both from the same kind of pipe, but one of which (b) was calorised; the two were heated side by side, with an ordinary laboratory blast lamp to a temperature of about 900° C. for a period of four hours, then cooled, and the heat once more applied for another period of four hours. At the end of that time the untreated pipe (a) was badly burned, the point where the flame was directly applied having been reduced to one-half the original thickness, while the whole surface was blistered. The contrast between this piece and that which was calorised (b) is very marked, for even upon close examination the calorised pipe appears to be unchanged.

The piece of calorised pipe used in this experiment had previously been used in other work, where it had been alternately heated to 1,000° C. and cooled, in an electric resistance furnace open to the air. The total time during which the maximum temperature was maintained was about 50 hours. A rather extreme test has been applied to this same piece lately, by heating it to about 900° C. and plunging it into cold water, after it had cooled to a dull red. This has been repeated three times, and the surface shows no signs of cracks or any tendency to scale.

Fig. 2 shows a similar comparison between two pieces of sheet iron tube, one calorised and the other not, which were both subjected to a temperature of 800° C. in a gas furnace for 100 hours. The uncalorised piece is practically destroyed, while the calorised piece is unharmed.

Another application of this process is to iron wire or ribbon such as is used in electrical heating units. An untreated piece of this ribbon will burn out in four or five hours at the most, whereas tests upon calorised pieces have shown that the life is increased at least fifty-fold, and in the best instances, over one hundred-fold. The results of tests made at Pittsfield indicate that a life of over 500 hours may be expected from calorised heating units run at a temperature of 800° C.

The above facts seem to indicate that this is a simple method for extending the use of iron under oxidising conditions at high temperatures, and for greatly prolonging the life in those instances where it is now used, but must be renewed at frequent intervals. While the life of the coating depends on the temperature at which it is used, as well as on the duration of time taken in its preparation, *i.e.*, the quantity of aluminium which alloys with the surface of the iron, it does not permit of long use at temperatures much in excess of 1,100° C.

Copper parts also, which are exposed to high temperatures, can have their life increased by calorising. In some cases calorised copper may be used advantageously in place of aluminium bronze. For instance, a large power station had trouble from early corrosion of its condenser tubes. These tubes were aluminium bronze and were supposed to last at least a year. As a matter of fact, while occasionally tubes would last as long as six years, other tubes would fail in four to six weeks after they were installed. About two and a half years ago a set of calorised copper tubes was installed, and so far not a tube has failed.

In some cases the life of copper contacts can be increased by calorising. For instance, a set of railway controller contacts which were calorised showed double the life of the ordinary untreated contacts.

As has been said, the effect of calorising is to produce a surface alloy containing aluminium. The thickness of this alloy varies with the length of time to which the piece is subjected to the calorising process, and the percentage of aluminium varies through the coating being greatest at the surface. This is shown clearly by a cross-section of a calorised

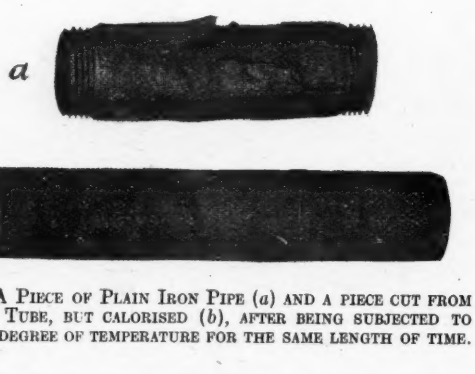



FIG. 1.—A PIECE OF PLAIN IRON PIPE (*a*) AND A PIECE CUT FROM THE SAME TUBE, BUT CALORISED (*b*), AFTER BEING SUBJECTED TO THE SAME DEGREE OF TEMPERATURE FOR THE SAME LENGTH OF TIME.

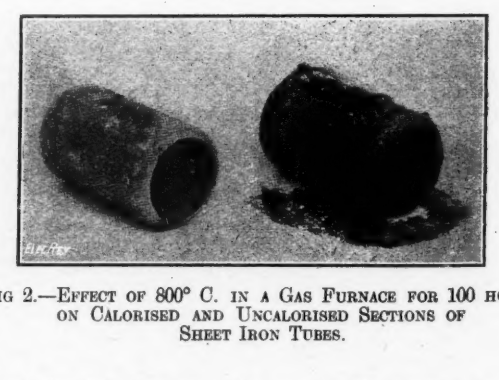


FIG 2.—EFFECT OF 800° C. IN A GAS FURNACE FOR 100 HOURS ON CALORISED AND UNCALORISED SECTIONS OF SHEET IRON TUBES.

copper rod. The line between the alloy and the unchanged copper is sharp, but the colour of the alloy varies from a rich golden-yellow next to the copper to a silvery-white at the surface.

When an iron pipe or ribbon is calorised for a heating unit, a portion of the iron becomes alloyed with the aluminium. Naturally, this results in changing both the resistance and the temperature co-efficient. The thicker the calorising coat the greater is the change. This is shown by the following table, in which No. 1 was given a lighter coat than No. 2.

| Sample. | Ohms per M. (19°) | Temp. Co-ef. Elec. Resis. (0-150°) × $10^3$ |
|---|---|---|
| Iron ribbon ... ... ... | 0.905 ..... | 5.61 |
| Same calorised, No. 1 ... | 2.45 ..... | 1.72 |
| Same calorised, No. 2 ... | 7.6 ..... | 0.151 |

A thin ribbon may easily be calorised all the way through, and then becomes quite brittle.

The dimensions and weight of either a copper or iron piece are slightly increased by calorising. The increase of dimension is much less than the thickness of the alloy coat, the greater part of which simply takes the place of the original metal. The dimensions may, however, increase several mils and there is a tendency to a greater increase at the edges than on flat surfaces.

For iron, calorising is intended only for protection at high temperatures. It does not compete with galvanising, sherardising, and other similar processes for protection against oxidation or corrosion at low temperatures. Its usefulness lies within a range of temperature much higher than a galvanised or sherardised coat could stand. For copper, calorising is effective against corrosion at low temperature as well as against oxidation at high temperature. The upper limit is determined by the melting point of the alloy, which is somewhat lower the heavier the calorising treatment, since that means an alloy with a higher aluminium content.

The probable explanation of the effect of the aluminium in the surface alloy is that a thin coat of alumina forms which prevents further burning of the metal beneath. It is well known that a pure aluminium wire may be heated in the air to a temperature several hundred degrees above its melting-point, without flowing, when the thin alumina shell which surrounds and supports the molten metal is easily seen.

## INDIAN NOTES.

[FROM OUR SPECIAL CORRESPONDENT.]

Business among electrical contractors remains brisk in spite of the increase in prices at home and of the irregularity of shipments. The present extraordinary price of home copper —the latest notification from cable manufacturers being that copper is £104 per ton—has raised the local price of insulated wire about 35 per cent., and, consequently, petty contractors are having a thin time, and especially those who imported cheap Continental wire, which is now, of course, unprocurable. In fact there is a scarcity of wire all round, and manufacturers' representatives, such as Glover's, Henley's, and Callender's, have been obliged to turn down orders for small sizes of 600-megohm grade wire.

The metallic filament lamp is about the only electrical supply left whose price has not yet been increased due to the war. It is reported that the representatives of the larger agencies —the Osram, Edison & Swan, Mazda, and Wotan—meet occasionally in solemn conclave to endeavour to come to some agreement to maintain rates to a level which will yield them a reasonable profit, or, at any rate, prevent under-cutting. At present some outstanding yearly contracts have to be fulfilled at the rate of 14½d. per metallic filament lamp of 225 volts, 20-60 watt, including delivery to mills, railways, and Government stores. This is under-cutting with a vengeance. The agents for the Phillips lamp, made in Holland, are doing good business in half-watt small candle-power sizes, which, apparently, the other firms cannot supply.

*Jammu.*—The State engineer is calling for tenders for a stand-by plant for the hydro-electric installation to consist of the following:—

Two water-tube boilers to evaporate 3,500 lb. of water.
Two mechanical stokers.
Two Weir feed pumps.
Feed-water heater.
Steam, exhaust, and feed mains.
Two steam alternators, 130 KW., 3,000 volts, 50 cycles, at 428 R.P.M., p.f. .8, temperature rise not to exceed 60° F. above an initial temperature of 95° F. at 1,200 ft. above sea level.
Switchboards and the necessary transformers.
Overhead travelling crane, 4 tons, 25 ft. span.
Steel chimney.

All above to be in working order on site by June, 1916. Probably inquiries are being sent home by this mail (July 1st) to the various manufacturers from their agents in India.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NEWFOUNDLAND.—The Customs Authorities have decided that the surtax of 10 per cent. provided for under Act No. 25 of 1914 is to continue in force.

EAST AFRICA PROTECTORATE.—The free importation of the following goods has been provided for: Electric cable or wire, the posts for carrying the same, and all other material for the purpose of generating, storing or distributing electric energy, whether for power or lighting, on satisfactory proof to the Chief of Customs that such articles and materials are imported solely for such purposes. Such exemption is not to include lamps and their fittings or material other than industrial machinery required for the purpose of using electric energy. The above replaces the following item in the free list, which is now repealed:—Apparatus and appliances used in connection with the generation and storing of electricity, but not including electric cable or wire, or the parts for carrying the same, and not including lamp-posts or lamps or their fittings.

NEW ZEALAND.—The Customs Authorities have issued the following decision: "Pipes (iron) and fittings for same (conduit for electric wiring), with or without inspection lids," dutiable according to size at 30 per cent. and 20 per cent. *ad val.* if of foreign origin, and 20 per cent. and free if of British origin.

PORTUGAL.—The exportation of the following articles to foreign countries from the mainland of Portugal and from the adjacent islands has been prohibited: "Carbons for electric light; ferro alloys; articles of copper or brass partly or wholly manufactured. Prohibition is not applicable to commercial operations carried out in virtue of contracts already entered into. Such contracts must, however, have been confirmed within 15 days of June 5th before the Commissao de Subsistenciao, and the goods in question be withdrawn within one month after permission has been given by the Ministry of Finance as a result of the decision of the Commissao.

ASHANTI.—The tariff on goods imported, which is in force in the Gold Coast Colony, has been made applicable to goods imported into Ashanti, but it has been provided that the Chief Commissioner may, by order in writing, permit any goods to pass through Ashanti in transit to the Northern Territories without payment of duty in Ashanti.

RUSSIA.—The Board of Trade have been notified that certificates of origin for goods shipped to Russia will be dispensed with in the case of goods which arrive in Russia direct from Allied countries, nor will such certificates be required in the case of foreign goods dispatched to Russia from Allied countries by parcels post. When goods from Allied countries are imported into the Empire after passing in transit through other countries, or after trans-shipment at intermediate ports, certificates of origin issued at the place of dispatch only will be required. Russian diplomatic and Consular officers will certify only the signatures on the certificates, and not the accuracy of the statement regarding the origin of the goods covered by the certificate. Certificates of origin will not be required for the undermentioned goods, among others, imported into Russia: Aluminium, asphalt, copper, gutta-percha, rubber.

HOLLAND.—The exportation of electric pocket lamps, parts thereof, and raw materials for the manufacture thereof, from Holland has been prohibited.

SWITZERLAND.—The exportation of the following goods has been prohibited: Carbon stems for pocket electric lamps; copper, lead, zinc, tin, or metal manufactures wholly or partly finished, except machines, mechanical contrivances, instruments, and apparatus; electric transformers and detached parts thereof; electric pocket lamps and cases, and other detached parts thereof.

RHODESIA.—The "general" tariff on goods unspecified in the Rhodesian tariff (which includes many kinds of electrical goods) has been increased from 15 per cent. to 20 per cent. *ad valorem*; the tariff on British goods remains the same, viz., 9 per cent. *ad valorem*.

ST. LUCIA.—Irrigation, mining, and other machinery for industries of all kinds, except agriculture, have been removed from the free list, and are now subject to duty.

SPAIN.—The exportation of manufactures of aluminium has been prohibited.

SERBIA.—The importation, except by the State, of the following is prohibited: Apparatus and accessories for electric signals, etc., and wireless telegraphy apparatus.

SALVADOR.—The Board of Trade are informed that when the total value of goods shipped to Salvador, as declared in Consular Invoices, is inferior by more than 15 per cent. to the value for which they are insured, Consular fees will be charged on the insured value, and the original policy must be produced as evidence of the insured value.

## NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this Journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

10,117. "Manufacture of tungsten." J. C. BUTTERFIELD. July 12th.

10,121. "Incandescent electric lamp of two zig-zag metallic filaments giving three grades of light." T. P. CASOTTI. July 12th. (Complete.)

10,130. "Electrically-controlled electric circuit breakers." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO., LTD. July 12th. (Convention date, July 11th, 1914, United States.) (Complete.)

10,131. "Arrangement for supplying electrical energy to direct-current electric motors." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO., LTD. July 12th. (Convention date, July 11th, 1914, United States.) (Complete.)

10,133. "Process for the electrolytic deposition on all metals of aluminium, tin, nickel, copper, zinc, iron, steel, or alloys thereof." P. MARINO. July 12th. (Complete.)

10,134. "Process of electrolytically depositing lead or tin on galvanised iron or alloy of zinc-lead or zinc-tin or iron or steel surfaces." P. MARINO. July 12th.

10,137. "Primary cells." F. A. WILKINSON. July 12th.

10,192. "Centrifugal compressors." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 13th.

10,199. "Electrical apparatus for producing hot and cold currents of air." E. B. WRIGHT. July 13th.

10,204. "Sparking-plugs for internal-combustion engines." DAIMLER-MOTOREN GES. July 13th. (Convention date, July 20th, 1914, Germany.) (Complete.)

10,214. "Casings of ammeters and voltmeters." WALSALL ELECTRICAL CO., LTD. July 14th. (Divided application on 9,023/15, June 19th.)

10,226. "Inter-connecting the electrical conduits of two railway cars." J. WOLLENMANN. July 14th. (Complete.)

10,228. "Telegraph systems." O. SRNKA. July 14th. (Conventino date, June 15th, 1914, Austria.) (Complete.)

10,229. "Telegraph systems." O. SRNKA. July 14th. (Addition to 10,228/15.) (Complete.)

10,231. "Vibrators for induction coils and the like." A. E. BEATTIE. July 14th.

10,242. "Shaft packings." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) (July 14th.)

10,245. "Thermostats." H. H. GRUNDY. July 14th.

10,251. "Electric condensers." W. H. WILSON. July 14th. (Addition to 19,506/14.) (Complete.)

10,270. "Connection of electrical instruments." J. ROOTHAAN, A. H. HIGGS, & FERRANTI, LTD. July 14th. (Complete.)

10,272. "Amplification of wireless signals." A. J. ROBERTS. July 14th. (Complete.)

10,276. "Electrically-operated relays and the like." C. H. WOODWARD. July 15th.

10,325. "Electrically-driven luggage track." J. E. HAMILTON. July 15th.

10,330. "Protective reactance coils." G. HARLOW. July 15th.

10,334. "Electric bells." M. SUWA. July 15th. (Complete.)

10,337. "Electro-deposition and refining of zinc." J. N. PRING. July 15th. (Partly communicated by Urlyn Clifton Tainton, South Africa.)

10,350. "Electric light fittings." S. FILDES. July 16th.

10,370. "Centrifugal compressors." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States). July 16th.

10,373. "Detectors for wireless signalling." T. W. STRATFORD-ANDREWS. July 16th.

10,374. "Insulation-testing devices for electric lighting and power installations." R. H. GOULD. July 16th.

10,412. "Elastic fluid turbines." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States). July 17th.

10,420. "Electric transmission systems for motor vehicles." N. SHUTTLEWORTH. July 17th. (Complete.)

10,421. "Insulators." J. ROTHAAN & FERRANTI, LTD. July 17th. (Complete.)

10,422. "Electrical connections." J. WOOD, H. G. FURLONG, & FERRANTI, LTD. July 17th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1913.

24,827. PROCESS FOR WORKING A RADIATOR HEATED BY GASEOUS LIQUID OR SOLID FUEL, OR BY ELECTRIC CURRENT OR STEAM. H. Frank. October 31st. (Patent of addition not granted.)

25,072. ARRANGEMENT AND CONNECTIONS OF ELECTRIC SWITCHGEAR AND SWITCHES THEREFOR. Siemens Bros. Dynamo Works, Ltd., C. A. B. D. Koettgen, & R. A. R. Bolton. November 3rd.

25,362. METHOD AND MACHINE FOR MAKING TUBING FOR CONDUCTING FLUIDS AND FOR ELECTRICAL INSULATION PURPOSES. P. Menzel. November 6th.

25,479. COOLING ARRANGEMENTS FOR ELECTRIC LOCOMOTIVES. Siemens Schuckertwerke Ges. November 7th. (May 26th, 1913.)

25,701. DEVICE FOR DISCOVERING FRACTURES IN WIRE CABLES. R. Wahn. November 10th. (November 11th, 1912.)

### 1914.

313. ELECTRIC SWITCHES. H. Wade (C. Kaisser). January 5th.

683. MEANS FOR COLLECTIVELY ACTUATING AND CONTROLLING ALTERNATING-CURRENT MOTORS. J. L. Routin. January 9th. (Patent of addition not granted.)

953. ELECTRIC SWITCHBOARDS. S. A. Green. January 13th.

1,871. CIRCUIT ARRANGEMENTS FOR TELEPHONE SYSTEMS. Siemens & Halske Akt. Ges. January 23rd. (January 25th, 1913, addition to 28,751/12.)

3,912. ARRANGEMENT FOR REGULATING THE PHASE DISPLACEMENT BETWEEN THE MAIN CURRENT AND VOLTAGE FIELDS OF A FERRARIS METER. Allgemeine Elektricitäts Ges. February 14th. (February 15th, 1913.)

3,986. ELECTRO-MAGNETIC SHAKING FEEDS OR JIGGERS FOR ELECTRO-MAGNETIC SEPARATORS. Maschinenbau Anstalt Humboldt. February 16th. (February 18th, 1913.)

7,589. DYNAMO-ELECTRIC GENERATORS. J. Stone & Co., Ltd., and A. H. Darker. March 25th.

7,590. DYNAMO-ELECTRIC MACHINES. J. Stone & Co., Ltd., and A. H. Darker. March 25th.

7,922. MICROPHONES, RELAYS, AND THE LIKE, ESPECIALLY SUITABLE FOR USE IN RADIO-TELEPHONY. A. F. Sykes. March 28th.

8,280. ELECTRIC DISTRIBUTION SYSTEMS. R. Arno. April 1st.

8,504. ELECTRIC TIME SWITCHES. P. Dresla. April 3rd. (April 3rd, 1913.)

8,794. RECIPROCAL CONNECTION FOR TWO TELEPHONE LINES, CONNECTED WITH A RELAY FOR REINFORCING TELEPHONE CURRENTS. P. L. M. Drumaux. April 7th (October 23rd, 1913.)

9,686. WAVE DETECTOR FOR WIRELESS TELEGRAPHY OF A MERCURY AND CRYSTAL TYPE USING CARBORUNDUM OR OTHER CRYSTALS. Kuhr & Bridges. April 20th.

11,222. TELEGRAPHY. A. Oglivie & Creed, and Bille & Co., Ltd. May 6th.

12,941. MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co., United States). May 26th.

15,270. APPARATUS FOR TRANSMITTING PICTURES OF MOVING OBJECTS AND THE LIKE TO A DISTANCE ELECTRICALLY. S. L. Hart. June 25th.

15,338. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co., United States). June 26th.

15,485. ELECTRIC ARC LAMPS. Planiawerke Akt. Ges. für Kohlenfabrikation. June 27th. (March 6th, 1914.)

15,727. INTERCOMMUNICATION TELEPHONES. H. G. White & J. H. Parsons. July 1st.

16,007. INCANDESCENT ELECTRIC LAMPS. W. W. D. Knight & H. E. Clerk. July 4th.

16,027. INSULATION OF DYNAMO-ELECTRIC MACHINERY. Micanite & Insulators Co., Ltd., and J. Allan. July 4th.

16,126. APPARATUS FOR THE ELECTRIC SOLDERING OF THIN OBJECTS BY MEANS OF INDIRECT HEATING. Allgemeine Elektricitäts Ges. July 6th. (August 12th, 1913.)

16,327. ELECTRIC CIRCUIT CONTROLLING DEVICES. British Thomson-Houston Co., Ltd. (General Electric Co., United States). July 8th.

16,380. RECEIVING ARRANGEMENTS FOR WIRELESS TELEGRAPHY. R. C. Galletti and Galletti's Wireless Telegraph & Telephone Co. July 9th.

16,424. APPARATUS FOR CALLING ATTENDANTS. Sterling Telephone & Electric Co. and F. G. Bell (Telephon Fabrik Akt. Ges.). July 9th.

16,575. ELECTRICAL RELAYS. A. H. Railing & C. C. Garrard. July 11th.

17,399. TELAUTOGRAPHIC APPARATUS. A. G. Bloxam (Telepantograph Ges.). July 22nd.

18,761. TERMINAL BOXES FOR ELECTRIC CABLES. W. B. Woodhouse and Callender's Cable & Construction Co., Ltd August 17th.

19,344. ELECTRICAL CONNECTIONS. H. Lucas & W. H. Edwards. September 2nd.

19,484. DEVICES FOR SUPPORTING AND INSULATING CONDUCTORS APPLICABLE FOR ELECTRIC RESISTANCES AND HEATERS. P. Good & A. E. Woodhouse. September 5th.

20,330. MAGNETO-ELECTRIC MACHINES FOR IGNITION IN INTERNAL-COMBUSTION ENGINES. M. S. Conner. September 30th.

20,580. ELECTRIC LAMPHOLDERS. J. H. Collie. October 6th.

21,794. CIRCUIT ARRANGEMENTS FOR TELEPHONE INSTALLATIONS. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges.). October 30th.

21,936. ELECTRICAL RELAY APPARATUS. C. B. Burdon (Siemens & Halske Akt. Ges.). November 3rd.

22,047. ELECTRIC ADVERTISING DEVICES AND SIGNS. F. C. Reilly. November 5th.

23,686. DRIVING ARRANGEMENTS FOR DYNAMOS. G. Kocsis & J. Lücö. December 7th.

23,884. ELECTRICALLY-ACTUATED TOOLS. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co.). December 10th. (Divided application on 18,738/14, August 17th.)

### 1915.

945. ELECTRIC SWITCH AND FUSE SERVICE BOXES. H. F. Reason. January 20th.

1,085. CONTROLLING AND INDICATING ELECTRIC MOTORS FROM A DISTANCE AND THE APPLICATION THEREOF TO WEIGHING MACHINES. Stothert & Pitt, Ltd., and E. S. Franklin. January 22nd.

1,468. STARTING MEANS FOR VAPOUR ELECTRIC DEVICES. F. Conrad. January 29th. (January 30th, 1914. Addition to 37/12.)

5,676. ALTERNATING-CURRENT VOLTMETERS. H. S. Dransfield. April 15th.

5,866. LANTERNS FOR ELECTRIC LAMPS. R. Bosch (firm of). April 19th (June 15th, 1914.)

7,013. DYNAMO-ELECTRIC MACHINES PARTICULARLY APPLICABLE FOR ENGINE STARTING SYSTEMS. C. F. Kettering & W. A. Chryst. May 10th. (July 14th, 1913. Divided application on 13,022/14, May 27th.)

**The Ideal Light Source.**—A paper read at the annual meeting of the American Electrochemical Society, by Dr. Herbert E. Ives, dealt with the ideal light, which, according to the viewpoint of the illuminating engineer, is not a brilliant point, but a surface of low intrinsic brilliancy, perhaps a surface of a window square. Dr. Ives pointed out that the vacuum-type tungsten lamp is 300 times as bright as the brightest object by day, namely, a white surface in the sun. The nitrogen-filled tungsten lamp is

LUMINOUS EFFICIENCY OF VARIOUS LIGHT SOURCES.

| | Luminous efficiency of the radiation, per cent. | Total luminous efficiency, per cent. |
|---|---|---|
| 4-watt carbon lamp ... ... ... | 0·45 | 0·42 |
| Vacuum tungsten lamp at 1·25 watts per candle ... ... ... ... | 1·65 | 1·3 |
| Nitrogen-filled lamp at 0·70 watt per candle ... ... ... ... | 2·93 | 2·4 |
| Welsbach mantle, 0·75 per cent. "Ceria" ... ... ... ... | 1·2 | 0·19 |
| Open-flame gas burner ... ... | 0·19 | 0·036 |
| Yellow flame arc ... ... ... ... | | 7·2 |

1,000 times as bright, and it becomes necessary to employ reflecting and diffusing media. What is required is a surface source of an intrinsic brilliancy of not over 0·001 C.P. per sq. cm. A true luminous paint which could be easily excited at will would meet this idea. A low intrinsic brilliancy is in great demand. The efficiencies of modern illuminants are surprisingly low. If we figure from coal, 1 per cent. is the best figure obtainable to-day. Light is actually only a small by-product. Dr. Ives gave the accompanying figures of recent measurements made by him of total luminous efficiency based on 50 C.P. per watt as the mechanical equivalent of light.